THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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ELECTRIC POWER ON THE RAND.

IT will be generally admitted that the paper which Mr. J. H. Rider presented to the Institution of Electrical Engineers last week was one of the most interesting and informative essays that have been delivered in recent years. The subject was one of exceptional scope and variety, as may be inferred from the fact that the electric motors in operation have an aggregate of 142,300 H.P.—a colossal system—and the demand for compressed air, which is mainly used for working rock-drills, amounts to no less than 37,900 KW. Plant installed on so large a scale, and so constantly in operation that the load factor of the electrical system is 75 per cent., entails a heavy load of responsibility on the engineer, and affords unique opportunities for the acquisition of experience of the most varied character.

Electrical engineers may therefore be grateful to the author for drawing so freely upon his knowledge as he has done in this paper. While there are many points which invite comment, we wish to direct our readers' attention especially to the subject of main winding gear, which is of constantly increasing importance in connection with British colliery installations. It is not long since engineers in this country were discussing at great length, and with many detailed calculations, the question whether electrical winding could possibly compete with steam winding; that stage, through which so many of the applications of electricity have had to pass—for the British electrical engineer is slow to grasp the possibilities of new openings for his talents—has been safely traversed, and now the question is whether three-phase or direct-current motors offer the greater advantages for the purpose.

As in the case of so many other problems, the solution of this one depends upon circumstances, and it is impossible to arrive at a decision applicable to all cases. Where power is derived from the mains of a large power company, the conditions are in favour of the three-phase motor; where a private station of moderate dimensions supplies the power, the use of the Ward-Leonard system of control with a fly-wheel motor-generator set may be obligatory. Again, the size of the winder exerts an important influence on the decision; for a small winder the objections to the three-phase motor lose much of their force, and the advantages of the Ward-Leonard system are diminished. It will be remembered that Mr. C. P. Sparks in his recent paper showed that he employed both types of motor, and the same thing is found on the Rand.

Mr. Rider states that of 69 electric winders, only 9 are of the Ward-Leonard type. Most of the three-phase motors, however, were applied to winders converted from steam drive—47 in number—leaving only 14 wholly new three-phase winders, as compared with eight new D.C. winders. Mr. Rider also quotes Mr. Heather as stating that the saving in capital outlay due to using induction motors was probably £50,000. But the working cost must also be taken into consideration, and the author expresses no decided opinion on this point. Moreover, the addition of an eddy-current brake to the three-phase winder, with the accompanying motor-generator, &c., brings up the capital cost practically to that of the Ward-Leonard system, which is certainly far more handy to control, and probably possesses a much higher degree of safety in operation than the A.C. system. With the eddy-current brake retardation is effected with 45 KW. applied to the magnet system, whereas braking by reverse current on the winding motor requires an input of 1,600 KW., so that the advantage of using the brake is obvious. On the other hand, while several eddy-current brakes have been installed, it is quite clear that the majority of the three-phase winders used by the group of

mines are working satisfactorily without their aid. There is also a significant paragraph in which the author points out that three-phase motors running at comparatively high speeds and driving through gearing can be advantageou ly employed, whereas with the Ward-Leonard system the motor is preferably direct-coupled.

So impartially does Mr. Rider weigh the pros and cons, that it is difficult to detect in his paper any decided leaning towards either system; but, on the whole, while he says that each case must be considered on its merits, we think that where the arguments on either side appeared to be of equal weight, he would prefer to install the Ward-Leonard control.

Not the least interesting and valuable feature of the paper is the section dealing with the "troubles" that the author has met with, due mainly to faults in design and manufacture. These call for the earnest attention of our manufacturing firms, with a view to their avoidance in the future. Some of the examples cited of bad workmanship and material were absolutely disgraceful, and there is little consolation to be derived from Mr. Rider's statement, in his reply to the discussion, that they were fairly equally divided between British, American and German products. For faults in design, the author finds some excuse in the limited experience of the designer with regard to the work a machine may have to do; but this is really an explanation rather than an excuse. We fear that, only too often, designs for new types of machines are entrusted to men who have seen little or nothing of the processes for which the machines are required, and who cannot make good their deficiencies by a hurried search through the text-books available; though it may be flattering to the D.O. to be credited with the ability to design any mortal thing that may be called for, from its inner consciousness, sooner or later disaster is bound to come. It would be well worth while to dispatch a capable designer to the Rand, as well as to other important industrial centres, to find out exactly what is required and what unsuspected conditions exist that must be provided against.

Such papers as that of Mr. Rider afford immense assistance to those who have to supply the plant, and we trust that British manufacturers will profit by the information now at their disposal, so that full advantage may be taken of the opportunities that will be open to them after the war. An abstract of the paper will appear in our later issues.

The Russian Government and German Interests in Supply Works.

The more we read concerning the Russian Electric Lighting Co. of 1886, of Petrograd, the expropriation of which is proposed by the Russian Government, the more does it appear that the latter are in possession of better information than is revealed by the German and German-Swiss newspapers of the actual situation of affairs, or the liquidation of the company would not be contemplated even at the present time. The company was formed in 1886 as a Russian company on the basis of statutes which were sanctioned by the Russian Government. Lighting concessions were obtained from the City Councils of Petrograd and Moscow under definite agreements which provide, among other matters, that the former city possesses the right of acquiring the local undertaking for the first time in 1918, according to definite terms specified in the concession, whilst Moscow is similarly situated in regard to the purchase of the city undertaking in 1920. An extension of the company's scope was subsequently made to Lodz and other Russian towns, but the chief business was concentrated in the capital and in Moscow. Unfavourable early years, the loss of capital, the reorganisation undertaken in the nineties of the past century with the assistance of German and Swiss capital, the impossibility, as is said, of procuring further Russian capital, and the aid, sought for and obtained, of further German and Swiss capital—all these causes contributed towards the disposal of the greatest portion of the shares in Germany and Switzerland, a small portion only being in Russian and French possession. Indeed, it is stated that it was impossible to awaken interest in the shares to a greater extent in Petrograd, notwithstanding the efforts put forth in this direction. Gradually, however, the shares are declared to have been increasingly transferred to Switzerland; ordinary shares for 41,000,000 roubles and preference shares for 9,000,000 roubles were recently in Swiss ownership.

Now the Government must be in the position to know exactly from the company's records when those transfers took place, and to what persons or banks or other institutions in Switzerland the shares were diverted, and the question or origin of partly German banks or other partly German financial institutions in Switzerland, and their relations with German banks or other financial institutions or electrical firms in Germany, should probably also be known. If the Russian Government, however, are not in possession of details which prove that the company is merely a German undertaking under a Russian title, it is difficult to understand the drastic Bill which the Swiss *Neue Zurcher Zeitung* states, as a result of inquiries, the Government has prepared for the liquidation of the company. The Bill provides that the Government will appoint a commission to ascertain the value of the undertaking in full operation, and to consult the cities and third persons. After the price has been determined by the five representatives of the Government and the two cities, the cities of Petrograd and Moscow may acquire the undertakings in question during one month, at the fixed price. If the cities refuse, the right will pass to the Government, and if the State also declines to exercise the right, a public auction is to take place. During the period of the liquidation the management will be entrusted to a second commission of seven members, of whom three will be appointed by the Government, two by the two cities, and two from the existing board of directors.

The Russian Government would scarcely proceed with a Bill of this nature unless certain that the undertaking was almost entirely German. Russia has been so greatly indebted to foreign capital, and will be so to a still greater extent after the war, for the development of her enormous resources, that it is unlikely that steps likely to shake the confidence of foreign investors would be taken without excellent reason. If Swiss ownership has really preponderated in the company for several years past, the holders are assured of the support of the Federal Government in protecting their financial interests.

Rubber.

The rubber market has had a pretty firm appearance lately, and there have been times when the trade demand showed signs of developing upon a fairly satisfactory scale, while prices showed some improvement. The moderate quantities actually available were recently absorbed more freely than had been the case for some little time, and there seemed to be a little apprehension among consumers lest the filling of the extra requirements usually met with at this, the most active period of the year, in the manufacturing trades, should, combined with belated landings, lead to a temporary scarcity. There is a possibility, too, of shipments from the East being delayed owing to freight difficulties. Prospects as to consumption in Europe and America are quite encouraging, because war requirements are licking up such enormous quantities of material that the closing of the German market is hardly felt. Shipments to America should continue on a pretty good scale over the spring, provided matters proceed normally as regard shipments. The deliveries of plantation grades have been better than for some weeks past. The total outgoings in London during last month were 6,363 tons, or nearly 400 tons in excess of the arrivals. A very large portion has been absorbed by clearances for America. When allowance is made, however, for the increased stock of Para grades in Liverpool there seems little alteration in the total stocks here, which amounted on April 1st, to 8,980 tons against 6,609 tons last year, and 5,967 tons in 1913. It is generally acknowledged, however, that the London stocks as indicated above are misleading, because they include considerable quantities which have been actually sold, but have not been delivered, owing to transport and other difficulties. The enormously large contracts now in course of execution by manufacturers point

to the continuance of an active consumption, and holders appear to be quite hopeful as to the course of the market during the next few months. The Brazilian export trade returns have been officially returned for 1914 as 32,526 tons against 35,304 tons in 1913.

According to a telegram from the Government to the Malay States Information Agency, the reports of rubber from the Federated States for the month of March amounted to 3,418 tons, compared with 3,411 tons last month, and 2,418 tons in the corresponding month last year. Appended are the comparative statistics :—

	1913.	1914.	1915.	
January ...	2 131	2,542	3,473	tons.
February ...	1,757	2,364	3,411	,,
March ...	1 737	2,418	3,418	,,
Total ...	5,625	7,324	10,302	,,

Those who Fall by the Way.

The Electrical Trades Benevolent Institution has been in existence eight years, and its accumulated funds amount to less than £8,000—a total still unworthy of the electrical industry and utterly inadequate to meet its needs. "He that has no charity deserves no mercy," and charity certainly cannot be expected to come to us from outside if we of the electrical industry have not a faculty for it within. Further, it cannot be expected that employers and shareholders should make systematic contribution to electrical benevolence unless those who one day may wish to claim that benevolence, support it when they are on the upper spokes of Fortune's wheel. It is true that the income of the Benevolent Institution was nearly three times as great last year as in 1913, but very special causes contributed to that end, and, with war in progress, and every probability of increased demands for assistance in the near future, wholesale additions must be made to the sources of revenue. On the basis of the past two or three years' figures, it would be 60 years before one could enjoy the prospect of being accommodated in the Institution's almshouses, and at least two generations before the child of any worker in the electrical industry could be offered the shelter of an orphanage. Such a state of affairs is neither creditable to the electrical industry nor fair to the Benevolent Institution. The funds collected are administered faithfully and well, but they are totally inadequate. Expenses cannot be reduced, for they are already low for the range and amount of work done. It is income which must be increased, and as capital may not be spent, funds must be raised to provide sufficient dividends and interest to alleviate every genuine case of distress in that large and ever-increasing middle-class stratum of the electrical industry which has *no other organised benevolence to rest upon*. The primary object of the Institution is to render financial and other assistance such as will lead to permanent benefit, and in the past about 75 per cent. of the recipients of grants have been assisted to permanent employment. Later, as available funds increase, the activities of the Institution can be extended, but the first essential is to provide an ample and *secured* income.

If each of the five or six thousand electrical firms in the country subscribed five guineas, or even one guinea, per annum, and if each of the tens of thousands of employés who stand to benefit by the aims of the Institution contributed 10s. or even 5s. per annum, there would rapidly accumulate funds permitting relief to be given to everyone in distress in the electrical industry. A collection after every electrical staff dinner or public banquet would amount to a respectable total in the course of a year. There are many other pressing claims, but the electrical industry can and ought to establish a really adequate benevolent fund. As Mr. Garcke said on Monday in presenting the annual report of the Institution, the problem is not what is the right thing for each one of us to do, but what steps can be taken to awaken us to our duty and persuade us to perform it. "All mankind's concern is charity," and we issue a sincere and urgent appeal to the large number of persons engaged in the electrical industry who have not yet identified themselves with the excellent work and ambitions of the Electrical Trades Benevolent Institution.

THE BECK SEARCHLIGHT PROJECTOR.

In the course of a discussion before the Society of Illuminating Engineers recently, some particulars were given of a new searchlight arc invented by Mr. Heinrich Beck, and were published in our report of the meeting. Further information on this subject was given in a paper read before the American Institute of Electrical Engineers in February last, by Mr. C. S. McDowell, the gist of which is given below.

The author states that the lamp mechanism of a searchlight should keep the crater of the positive carbon at the focus of the mirror, should keep the arc length that which is desired, should carry the current of the carbons, should contain mechanism for rotating at least the positive carbon, should be sufficiently rigid to keep the carbons in proper alignment, and should require little care and adjustment.

An illustration of the Beck lamp mechanism is shown in fig. 1. Both carbons are rotated for the purpose of keeping their surfaces bathed in the inert gas and to keep the arc

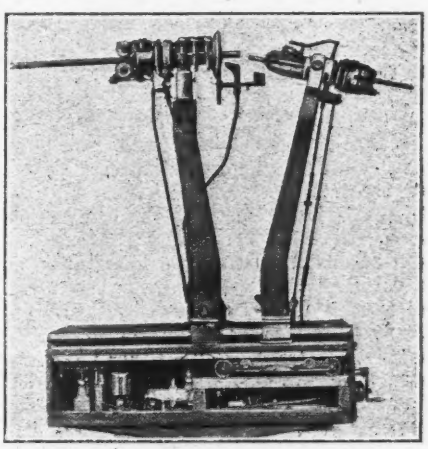


Fig. 1.—Beck Searchlight Lamp.

central, and thus promote evenness of burning. The positive holder is fixed, the carbon being fed through it at such a rate that the crater is always maintained at the focus of the mirror; the rate of feed is controlled automatically, a small mirror being placed in the drum, which, when the carbon feeds too slowly, reflects a small beam on a thermocouple, and closes a relay circuit, which, by means of a solenoid, quickens the feed. When the carbon is back in focus, the small beam of light is off the thermocouple and the feed is slowed down. In addition, the feed may be controlled by hand. The negative carbon is fed through the negative holder in a similar manner, except that the control is by hand. The negative holder is also fixed, except when striking the arc, when it is moved up by a striking motor.

During tests recently conducted on searchlights, the Beck lamp mechanism functioned very satisfactorily; variation of the crater of the positive carbon from the focus was about 1 mm. (hardly noticeable), and the arc length was kept practically constant. No trouble in maintaining the arc was experienced while rotating both carbons, the crater of the positive carbon remained even, and there was no noticeable hissing or jumping of the arc.

The desired searchlight arc should excel in the following particulars :—

1. Small positive carbons with high current densities and thus high crater temperature throughout the crater area, which gives high intrinsic brilliancy.
2. Small negative carbons.
3. Long arc length, that is, distance between positive crater and negative point.
4. Uniform mixture of carbon so as to help the evenness of burning.

The Beck searchlight may be considered as being especially

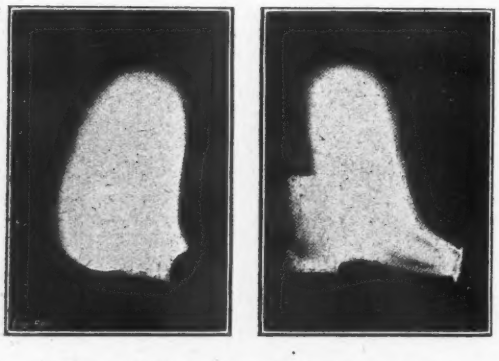
designed to meet the above requirements, and therein lies its marked superiority over the searchlights now in use.

In a searchlight the angle of dispersion is directly dependent on the diameter of the source of illumination, provided the focal length is constant, and if the diameter of the source can be decreased one-half while the candle-power remains constant, the intensity of light on the target will be quadrupled. Actually in the Beck searchlight, the positive carbon is reduced one half, and at the same time the candle-power is increased, so that greater efficiencies are obtained.

To decrease the angle of shadow it is necessary to increase the arc length or decrease the diameter of the negative carbon. The arc length is restricted to the stability point of burning. Whilst complying with this requirement, the arc length of the Beck lamp is maintained constant at about $\frac{7}{8}$ in. as compared with about $\frac{5}{8}$ in. obtained at 60 volts in the standard 36-in. lamp.

Carbon is the most refractory of all known materials, boiling at about 4,000° C, but it unfortunately commences to evaporate at a much lower temperature (about 1,800° C.), so that in an ordinary arc very little of the total area of the end of the positive carbon is at the melting temperature, a small wandering spot being the real efficient part of the carbon, and the rest of the end of the carbon is consumed at a much lower temperature, giving off less intense rays and a longer wave length. This may be readily seen in a comparison of the Beck and ordinary arcs by the colour of the arc.

In the Beck arc the ends of the positive and negative carbons are enveloped in hydrocarbon vapour, which prevents the consumption of the carbons at a lower temperature, by keeping oxygen from them; in addition it cools the outer shell of the carbons, the gas being at a temperature of about 1,000° C., and thus concentrates the current in the centre of the carbons. Thus a current density greater than 0·75 ampere per sq. mm. is obtained, and the whole crater of the positive carbon reaches a very high temperature. The current is brought to both carbons near the ends by roller contacts, so that the only part having this high current density is the part protected by the indifferent gas. The positive carbon is cored with a rare earth having a melting point of about 3,500° C. The positive develops a deep crater, about 12 mm. deep, filled with incandescent gas. The sides of this crater reflect the light radiation to the focus of the crater, and, in addition, the light from the negative is reflected, so it is believed that nearly true black-body radiation is obtained; and by adjusting the focus of the crater to the focal point of the mirror the high peak in the luminosity curve of the beam is thus produced.



Figs. 2 and 3.—Beck Searchlight Arcs.

The area of the Beck positive carbon is 201 sq. mm.; the area of the ordinary 36-in. searchlight positive carbon is 805 sq. mm. In the Beck light the maximum intrinsic brilliancy is greater than 438 c.p. per sq. mm. The intrinsic brilliancy of an ordinary carbon arc varies from 120 c.p. per sq. mm. to 160 c.p. per sq. mm.

In addition to the black body radiation obtained from the crater, there is evidently a large amount of light radiated from the incandescent gas in the crater, of a selective nature. It would probably at first be thought that this gas would follow Kirchhoff's laws and absorb the lines which it naturally radiated, giving the Fraunhofer lines seen in the sun's spectrum; but in this case the incandescent gas is at a higher temperature than the crater, and the spectrum shows positive lines apparently superimposed on the regular temperature radiation.

The temperature of the incandescent gas within the positive crater is estimated to be between 5,000° and 5,500° C. Two views of the Beck carbons burning with normal current densities are shown in the illustrations, figs. 2 and 3.

It is very hard to compare two searchlights by the eye, but during a test both searchlights were lighted (the Beck and the U.S. Navy 36-in.), and first one and then the other was turned on the same object, with the result that objects not distinguishable, except in a hazy way, with the Navy 36-in. were plainly outlined by the Beck light. It is apparent to the eye that the Beck light is more of a bluish-white light than the standard; the ordinary searchlight beam looks yellow in comparison. The aggregate quantity of blue and violet rays in the Beck beam is about 23 per cent. At low intensities of illumination the maximum sensation to the eye for the same strengths of illumination shifts towards the blue end of the spectrum, while at higher intensities of illumination the maximum sensation for the same strengths is towards the yellow part of the spectrum. This shifting of the relative sensations for different intensities of illumination

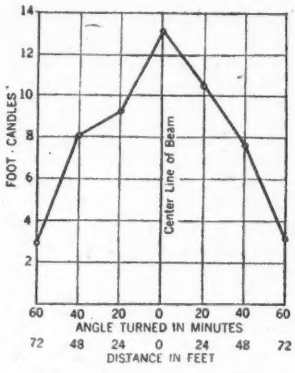


Fig. 4.—Foot-Candle-Power-Distance Curve of the Beck 44-in. Searchlight taken at a Distance of 2,850 ft. Lamp Burning Normally.

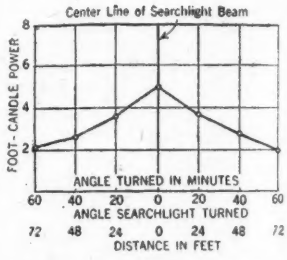


Fig. 5.—Foot-Candle-Power-Distance Curve of the Navy Standard 60 in. Searchlight taken at a Distance of 2,850 ft. — Lamp Burning under Normal Conditions.

is the well-known phenomenon called the Purkinje effect. It is thus seen that the Beck light is particularly good for picking up distant objects where the illuminative intensity would be small.

It is also a well-known fact that a coloured body reflects the colours from the rays falling on it which the body itself contains, and absorbs the rays which it does not contain; the Beck light being strong in the short waves of light would thus be particularly effective in picking up objects of a bluish colour, such as the various classes of ships painted bluish grey.

Comparative night illumination tests were conducted between standard 36-in. and 60-in. searchlights and the 44-in. Beck searchlight. The beam given by the latter was a more concentrated beam than that obtained from either of the standard lamps, and the colour of the Beck beam was whiter.

With the carbons burning in a normal condition and placed in the proper focal centres of their respective mirrors, foot-candle-power readings at intervals of 24 ft. were taken across the beam at a distance of 2,850 ft. from the searchlights. Figs. 4 and 5 show the illumination across the beam of the Beck searchlight compared with that of the 60-in. standard searchlight. From these curves it can be seen that the maximum illumination obtained from the Beck light is approximately two and a-half times as great as that obtained from the standard 60-in. projector. In the Beck searchlight beam the illumination is very high at the centre and falls off very rapidly at the edge of the beam.

The maximum candle-power obtained with the present U.S. Navy standard carbons is 45,000 c.p., as against 88,000 c.p. obtained with the Beck lamp.

From the *Electrical World* we reproduce fig. 6, showing the complete projector, with the spirit tank mounted on the side of the barrel. The vapour is generated from methylated spirit in a cylindrical chamber filled with wire gauze, and heated by a small electric resistance heater, the spirit being admitted at a uniform rate into the vaporiser, where it is volatilised on the hot metal parts, escaping in the form of gas through nozzles under the electrodes. The spirit is fed automatically, when the arc is struck, by an electromagnetically-controlled valve.

The diameter of the negative electrode for 150 amperes is only 11 mm., and, owing to the protective effect of the vapour, the rate of consumption is only 50 to 60 mm. per hour; for the positive electrode a rate of 200-250 mm. per hour is allowed. The positive electrode can be renewed in a hot projector in a few seconds, and whereas the ordinary projector arc burns unsteadily until the carbons have settled down to shape, the Beck arc is ready for work within a few seconds.

The positive electrode is 16 mm. in diameter, as compared with the ordinary carbons, 38 mm. in diameter, for the same current (150 amperes). The positive is not reduced to a point, but maintains its full diameter up to the crater.

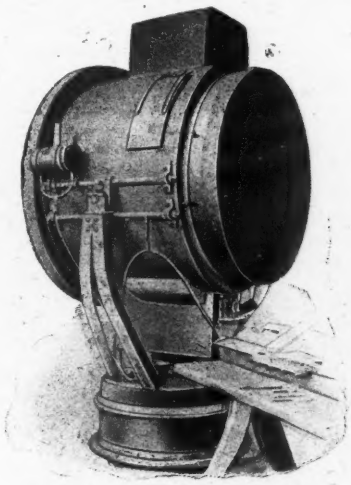
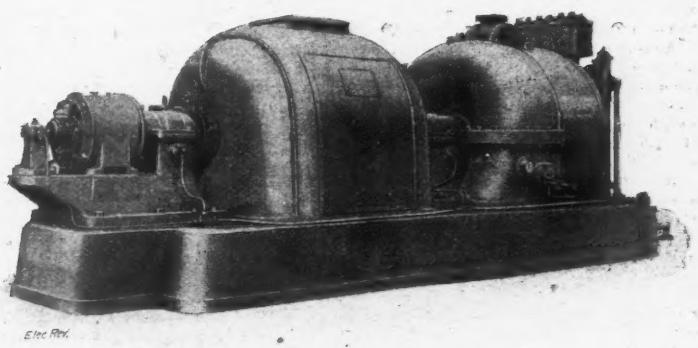


Fig. 6.—Exterior of Projector.



B.T.H.-Curtis Turbo-Generator, as Installed at Swansea.

SWANSEA ELECTRICITY EXTENSIONS.

We referred in a recent issue to the three-phase plant which has been brought into use by the Swansea Corporation electricity department.

This consists of two 1,875-K.V.A. turbo-alternators, with rotary converters and the necessary H.T. switchgear at the power station, where also new boiler plant has been installed; H.T. trunk feeders, and sub-stations, only one of which, at Uplands, is ready for running at the moment.

The turbine plant is of the horizontal Curtis type supplied by the British Thomson-Houston Co., giving its rated output at 3,000 R.P.M. and supplying energy at 6,600 volts and 50 periods. Overloads of 25 per cent. for two hours and 50 per cent. for 10 minutes are provided for, with normal steam pressure (150 lb.) and 85 per cent. vacuum. Centrifugal and emergency governors are fitted and the governing can be electrically adjusted from the switch gallery. The air for ventilating the turbo-alternators is supplied through ducts from dry air filters fixed outside the building.

The turbines exhaust into Cole, Marchant & Morley condensers, in connection with which are Edwards air pumps and circulating pumps, the pumps for each condenser being driven by a single motor.

Each condenser is designed to maintain a 28-in. vacuum when dealing with 27,000 lb. of steam per hour, with cooling water at 65° F. and a 30-in. barometer.

The three-phase H.T. switchgear was supplied by the British Westinghouse Co., and is of the remote controlled type; the L.T. control switches and instruments are mounted on a bench board, provided with red and green lamp indicators.

The bus-bars oil switches, &c., are enclosed in moulded stone cubicles. This switchgear controls the two turbo-alternators, also two rotary converters and four three-core 1 sq. in. outgoing feeders. Two direct-current panels have also been supplied for the rotaries, arranged for either lighting or traction supply. The two rotary converters are of 500 KW. capacity each, of the six-phase type running at 750 R.P.M., and were also supplied by the British Westinghouse Co.

They are 8-pole horizontally divided machines, each with an alternating-current booster and squirrel-cage starting motor mounted on the same shaft, and supply either lighting or traction voltages; the main transformers are each of 550 K.V.A. capacity, of the oil-insulated self-cooling type.

The boosters allow of complete and independent control of the power factor on the A.C. side and of the D.C. voltage

The new plant in the boiler house consists of two Stirling water-tube boilers fitted with superheaters and underfeed mechanical stokers.

One boiler has a heating surface of 5,157 sq. ft. and a grate area of 91 sq. ft., and will evaporate 26 000 lb. of water per hour; in the case of the other boiler with 5 719 sq. ft. heating surface, and 93 sq. ft. grate area, the evaporation is 29.000 lb.

The superheaters, made by Superheater Units, Ltd., consists of four distinct units of 88 tubes giving a total heating surface of 580 sq. ft.

The stokers were supplied by the Underfeed Stoker Co., Ltd., and are of the push-plate type.

The Uplands sub-station plant consists of two 500-KW. rotary converters, together with the necessary transformers and switchgear.

The cost of this extension, for the particulars of which we are indebted to Mr. J. W. Barr, the borough electrical engineer, has been some £40,000.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Capturing of German Trade.

Now that the time for the electrical industry is here, in all seriousness—and has been for some time past, as a matter of fact—to arouse itself and concentrate on the prime factors which will enable it to capture and hold that large volume of trade which has been hitherto secured by our present enemies, the Germans, not only in these islands, but in all parts of our Empire, and also in the markets of our Allies, does it not behove the industry at once to set about what is one of the most essential primary movements to ensure this end?

It seems to me that the industry *en bloc* should immediately take those steps which will not only ensure the inception, but also the continuity, of the propaganda campaign, viz., by the preparation and publication of catalogues in, say, French, Russian, Spanish, and even in Japanese and Chinese, and, in fact, in the languages of all those countries with which we have every hope our mutual interests will be linked up and advanced in the future. We might leave the German language alone altogether, as, in any case, for some considerable time after peace is declared, it is highly improbable that we shall do much business with the Germans, at any rate, as sellers; as their customers we have had enough of them in the past, and should do all in our power not to give them the benefit of good British gold any more than we can possibly help, until such time as they can give us some evidence that they can to some degree be trusted. Therefore, for the time, blot their language out of our trade literature. The languages mentioned at the commencement of this letter will suffice for all international trading.

Perhaps one or two of the bigger and more important firms may be able to afford their own publicity and translation staffs, and will individually take up the running on the above lines, but there must be a large number of firms with not overflowing financial resources who would find it difficult, if not actually impossible, to employ their own translators capable of efficiently producing well-finished technical catalogues and propaganda.

Might I suggest that the present moment appears to be a particularly opportune one to institute a central organisation on behalf of the electrical industry (this might be undertaken under the auspices of the I.E.E. or the B.E.A.M.A.), where catalogue and propaganda matter might be efficiently dealt with by a competent body of linguists who have engineering training and capabilities. At this time, when there must be resident in this country a goodly number of electrical and mechanical engineers of French, Russian, and Belgian nationality, too old to join the fighting forces, or perhaps already incapacitated from further fighting, who would be only too glad to avail themselves of an opportunity to do something not only remunerative but also patriotic on behalf of their own particular country's future interests, such a central organisation could be established almost at once, I feel sure, given the necessary initiatory spirit.

There would be nothing to prevent the electrical firms from sending their copy to this institution, and paying for translations at a scheduled rate to be decided upon by the promoters and executive of the organisation. The particular style of cataloguing and printing could still be dealt with as at present by the firm's own printer or publisher. The writer has spoken to several representatives of publishing houses, and feels sure that there would be no hesitation in these firms quickly adapting themselves to the demand by the provision of the necessary type of printing—for instance, Russian type is somewhat outside the ordinary, likewise Japanese and Chinese—and, once having started, the trade for them in this direction would undoubtedly be a remunerative one.

Again, surely we have now had enough of the suspicion of each other among our home manufacturers. No doubt the German element in our midst was greatly responsible for this, but with that element eliminated, and the experiences which the war has taught us, undoubtedly there will be a return to the good old British axiom, so prevalent in the days of our trading forefathers, of "Let us trust each other."

Each firm's specialities are nowadays so defined, and it is—and always has been—such an easy thing for any firm to get hold of its rival's catalogue, that there should no longer be any distrust or hesitation in deciding upon some course which will work out, not only effectively but comparatively economically, in the common cause of the industry.

The writer hopes that the idea put forward may receive the serious consideration of the electrical trade, but the principal point is—not to adopt the *laissez faire* policy, but that of "Do it now!"

The principle might be extended to the establishment of a central school of languages for the teaching and training linguistically of commercial and engineering travellers, who will eventually be required to follow up the propaganda in foreign countries—*i.e.*, if we have learned anything or are likely to learn anything as the outcome of this terrible world upheaval, and we are to ensure that never again will Britain be caught napping.

The average monolinguistic Englishman has for many years been almost the laughing-stock of his German rival, because he could not speak several languages, but the writer fancies this will be another instance where "those laugh best who laugh last," and, as in the matter of fighting, the Englishman will prove himself also not wanting in the matter of linguistic achievements, when he recognises the necessity of grappling with the issue.

Suggestive.

London, *April 19th*, 1915.

Electric Road Rollers.

The letter *re* "Electric Road Rollers" from your correspondent, Mr. Topliss, is particularly interesting, as the next issue of the *Electric Vehicle* will deal largely with electric battery traction for municipal purposes, and the question of electric road rollers will be dealt with in an Editorial.

I have sent the draft to a well-known maker in order that any possible "bloomers" may be eliminated, as I am not an expert in this type of machine, but, from a common-sense point of view, it does seem to me that electricity applied to road rollers ought to change for the better the whole aspect of this branch of municipal work. The present steam roller is an unmitigated nuisance on account of its noise, smoke and dirt.

The necessary weight can easily be obtained in the form of the battery, and there is no question whatever that the cost of upkeep (repairs, maintenance and power), must be considerably less than with the steam or petrol-driven machine. I believe if one or two enterprising makers took the matter up—it would result in advantage to them, and to the central-station engineer, who would tap a big source of revenue.

The journal does not go to press until the end of May, and in the meantime any information on the subject that your readers can send me will be very welcome and help along the movement.

A. Hugh Seabrook,
Hon. Editor, The Electric Vehicle.

London, W., *April 17th*, 1915.

Ball-Bearing Extensions.—The Hoffmann Manufacturing Co., Ltd., of Chelmsford, are still further considerably extending their already large works. Their ball-bearing hanger for line shafting has been in great demand during the past year, the total supplied being sufficient to carry 42,000 ft. of line shafting at normal pitch.

LEGAL.

Taunton *v.* Harkness Bros.

The Electric Appliances Co. were on April 15th defendants in an action heard in the King's Bench Division, before Mr. Justice Low and a common jury, in which Mr. Thorn Lionel Taunton, a traveller in electrical fittings, &c., residing at Ealing, claimed commission and compensation for wrongful dismissal.

According to the opening statement of Mr. Mayer, K.C., who appeared for the plaintiff, an agreement was entered into verbally between plaintiff and Messrs. Harkness Bros. for him to travel in vacuum cleaners on commission and £1 a week for travelling expenses. The engagement dated from May, 1911, and the plaintiff's operations were confined to London. Subsequently Messrs. Harkness's business was turned into a company, and plaintiff continued his duties under the original agreement. In 1913 he was asked to give demonstrations with the vacuum cleaner upon the understanding that his commission should continue while he was so engaged, and that his interests, which would be looked after by others meanwhile, would not be affected. The defendants then asked him to part with half of his commission to those who looked after his business, but this he declined to do. Subsequently differences arose over the plaintiff's letters from customers being opened at the office and acted upon by other travellers, and plaintiff wrote stating that letters from his clients addressed to him personally "must" remain unopened and left for him to deal with personally. To this communication the defendants took exception, characterising it as impertinent, and demanding a written apology within 24 hours, failing which he would be given a week's notice. The plaintiff told the defendants' directors that he was sorry they should have regarded the word "must" as offensive, and assured them that it was not so intended. They, nevertheless, gave him the week's notice, and he had to leave.

The Plaintiff was called, and in the course of his cross-examination his Lordship said there was no justification for saying that he (plaintiff) had been guilty of misconduct, as was alleged as the reason for his dismissal at a week's notice instead of six months, claimed to be the custom where travellers were paid by commission only. It was absurd to say that the word "must," as used by the plaintiff, was offensive, and his neglect to send a written apology could not be construed into a refusal to obey reasonable orders. It was clear that there had been no misconduct, and it was a serious matter to make such a charge against a man where there was no foundation for it. He suggested that the parties, under the circumstances, might come to some arrangement.

After consultation between counsel, it was agreed that judgment should be entered for the plaintiff for an agreed amount, with costs, and that the £26 3s. 7d. paid into Court by the defendants should be paid out to the plaintiff's solicitors.

Judgment was accordingly entered for plaintiff for an agreed amount, endorsed on counsel's briefs, with costs.

Prize Court.—Seizure of Electric Fans.

Sir Samuel Evans, presiding over the Prize Court, again had before him a few days ago the case in which the Crown asked for condemnation of five cases of electric fans seized on board the P. & O. steamship *Poona* in London on October 17th. The goods were claimed by Isaria, Ltd., of 208, Tower Bridge Road, a company duly incorporated in England on May 30th, 1912. The matter was adjourned from last term for further evidence to be produced by the claimants.

Mr. A. W. Elkin, on their behalf, said he now produced certain documents which were asked for on the last occasion. The first was a duplicate of the agreement made between claimants and Messrs. Lascelles, Parrington & Brasche, of Melbourne, appointing the latter their agents in Australia. The original was in Melbourne. That proved beyond doubt, he submitted, that Messrs. Lascelles, Parrington & Brasche were claimants' agents. The next documents consisted of a bundle of reports from Mr. Charles Brandt, claimants' traveller in Australia, and a number of commission notes between claimants and their agents.

The President said it rather looked from these documents as if the goods belonged to the claimant company, and that Messrs. Lascelles, Parrington & Brasche were only the agents for sale, and Mr. Brandt was the traveller. He would like to see the share register of the company.

Mr. J. B. Aspinall (for the Crown) said he had a list of the shareholders, dated July 18th, 1914. There seemed to be seven shareholders, all German. He gathered that his Lordship was satisfied that these goods were the property of the Isaria Co.

The President said he would like to have some further evidence from Mr. Moreton, the manager of the company.

Mr. Frank Moreton, recalled, stated that the document appointing him manager was signed by Mr. Ludwig Schoenmann, the engineer and secretary, and by Mr. Carl Seifer, the commercial manager, on August 3rd.

The President: What became of them after they appointed you?

Witness: They left the country on the night of August 3rd, to the best of my knowledge. I think they went to Germany *viâ* Copenhagen.

Have you had any communication with any of the directors since you were appointed?—No; I account to no one but the Board of Trade Supervisor.

Replying to Mr. Elkin, Witness said that the Board of Trade

were quite satisfied with his mode of carrying on the business, and they countersigned all the cheques drawn by him on the company's account.

Cross-examined by Mr. Aspinall, Witness said he did not know what authority the two gentlemen who appointed him manager had so to do. He assumed they had authority from the directors.

Mr. Elkin submitted that Mr. Morton was properly appointed, and that having regard to the fact that the claimants were a duly incorporated company in this country they were entitled to the release of these goods, on the authority of the decision of the Court of Appeal, in the case of the Continental Tyre and Rubber Co. *v.* Tilling.

The President: Supposing this company constituted as it is wanted to buy ships, could it own them?

Mr. Elkin said that had not been decided.

The President remarked that it would be very odd if the company was the owner of the ship and also the cargo, and was entitled to the cargo and not to the ship.

Mr. Elkin said he relied very strongly on the decision of the Court of Appeal.

The President said he was willing to pay all deference to that decision, but it did not bind him in that Court. He might after careful consideration come to the conclusion that he might be able to agree with Lord Justice Buckley's dissenting judgment.

Ultimately, his Lordship reserved judgment.

Trading with the Enemy.

In the City of London Court, on April 19th, a considered judgment was delivered by Judge Atherley-Jones, K.C., in a case of much trade interest and importance, in which Bruno Ullmann, successor to Bechmann & Ullmann, 21, Moor Lane, E.C., sued Mr. S. Nyman, 80, Westbourne Grove, Bayswater, for £11 5s. for trade goods supplied. The defence was that the plaintiff could not recover because of the Trading with the Enemy Act, although the defendant was quite prepared to pay if so ordered. Plaintiff, it seemed, was a German by birth, and was naturalised in 1899. In 1901 he said he went into partnership with Bechmann, a German. Bechmann died and the business passed to Ullmann. The goods sued for were ordered and delivered in March of last year. Plaintiff ranked as a British subject and was entitled to all the assets of the concern including the debt due from the defendant. There could be no question there of trading with the enemy. Plaintiff had communicated with the Board of Trade, the Treasury, and the Controller of Companies, and they had no objection to him recovering. Of course he would not part with the money or send it to Germany. The business here was a London branch. The headquarters were in Erfurth. The business here was a distinct entity. The goods supplied to the defendant were invoiced from London and Germany. Defendant said unfortunately his business was with foreign houses, and during the last two months there had been awful trouble through people paying money. He had already got into trouble with the authorities for paying in another case.

Judge Atherley Jones, K.C., said that as the point raised was a novel one and had never been before any Court, and as it was of great importance to every trader in this country, he had taken time to consider his decision. He had come to the conclusion that plaintiff could not recover as he was satisfied that the business of Ullmann & Bechmann was a German house. As for the correspondence with the Board of Trade, &c., it was immaterial, as Courts of Law did not found their judgments on the opinions of Government officials. Plaintiff's business in London was only an agency. Judgment for the defendant with costs, but he gave leave to the plaintiff to appeal, as he thought it quite likely that the Divisional Court might take another view. It was certainly a very important case.

National Freehold Land and Building Society *v.* Maurice Freeman.

An alleged nuisance by motor-driven machinery gave rise to this action, which came before Mr. Justice Sargant on April 19th, the plaintiff Society and their tenant, Battista Barzalia, claiming an injunction in respect of an alleged breach of agreement, and the defendant, also a tenant of the Society, counterclaiming for damages for alleged breach of warranty.

Mr. Stroud, in opening the case on behalf of the plaintiff, said he claimed an injunction to restrain the defendant from using or permitting to be used on his premises, the first floor of 39 and 40, Mitre Street, Aldgate, any machinery so as to cause a nuisance either to the plaintiffs or the other occupiers of the premises. The plaintiff Society were the landlords, and the plaintiff Barzalia was a tenant of theirs who carried on a restaurant business there. The defendant became the occupier of the first floor of the premises under an agreement dated January 15th last year, and he alleged that before entering into the agreement the Society, through its agents, had warranted the premises to be adapted for motive power. That gave rise to the counterclaim, the defendant contending that in the event of the second plaintiff recovering any damages, or an injunction being granted, he was entitled to claim against the society for breach of warranty. Prior to January 12th the defendant entered into negotiations with Messrs. F. Hilbury & Co., house and estate agents, of 140, Leadenhall Street, for premises suitable for his business of a buttonhole maker. In an interview with Mr. Hilbury the defendant explained that he required the premises for his business of a buttonhole manufacturer, and also mentioned that he would be using machines, but it was not suggested or brought to the knowledge of Mr. Hilbury in any way that there was any intention of introducing electric or other power on the premises. In a letter written before the tenancy agreement was entered into the defendant said he had ascertained that there was no electric light installed on the premises, but no reference whatever was made to electric power. Mr. Johnstone, the secretary of the plaintiff society, and Mr. Hawkins, a rent collector in their employ, had interviews with the defendant prior to the signing of the agreement, and both would tell the Court that though the defendant said that he would put machines on the premises they understood him to mean treadle or hand machines. Nothing whatever was said about power-driven machines. The defendant asked Hawkins whether there was electric light on the premises, and Hawkins by mistake said that there was, but nothing would turn upon that as the defendant afterwards had a letter stating the contrary. When the agreement was completed at Messrs. Hilbury's office, again nothing was said about power-driven machines. The agreement was for a tenancy of the whole of the first floor of 39 and 40, Mitre Street, and the clause upon which the plaintiffs relied was that the tenant covenanted to do nothing that might cause nuisance or annoyance to the occupiers of adjoining property, nor carry on any trade or business except that of a buttonhole maker.

Mr. Justice Sargant: That would imply that he was not to use the premises for the business of a button-hole maker so as to be a nuisance, unless the nuisance was absolutely essential to the carrying on of a button-hole maker's business. The defendant would have to show that it was quite impossible to carry on his business without causing a nuisance.

Counsel, continuing, said that the defendant was let into possession, and he proceeded to make arrangements with an electric lighting company to install electric power without consulting the plaintiff society in way.

Mr. Justice Sargant asked whether the installation was for both light and power.

Counsel said he did not know.

His Lordship said he asked because there must have been a separate installation for power, as power was charged for at a different rate.

Counsel said he did not think it mattered, as there was no question that the defendant was working his machines by electric power. Mr. Hawkins visited the premises about some repairs and saw an electrician at work there, but thought it had merely to do with electric lighting. Barzalia wrote to the plaintiff society complaining of the nuisance and loss of custom in consequence, and after some correspondence, in which it was suggested that the nuisance might be obviated by more firmly fixing the machines, the present action was commenced.

Both sides agreed that if the Court should hold that the question was one of damages the amount should be fixed by his Lordship, to save the expense of an inquiry.

It was admitted, added counsel, that the defendant had installed on the premises a 2-H.P. electrically-driven machine.

Evidence was given in support of counsel's opening statement.

Called for the defence, and examined by Mr. Fortune, Maurice Freeman said that he had been in business in Old Street, and had used power-driven machines. It was perfectly understood when he took the premises in question that he would be using machines in his business, and the electrically-driven machines made little or no more noise than would hand or treadle machines. The machines he was now using stood on a bed about 3 ft. high, and were the best machines that could be got for his trade. There was no better method known in the trade of carrying on his business than the one he had adopted. As a buttonhole maker, he did not think his business could be carried on with less noise. All the large firms used these machines. He was now busy on Government work, and worked on a Sunday.

Cross-examined, Witness said that when he asked whether electricity was laid on on the premises, he did not lead Mr. Hilbury to suppose that his inquiry referred only to electric light. He asked whether there were electric wires on the premises, and he did not suppose that anyone could suppose his inquiry was confined to wires for electric lighting.

Re-examined, Witness said that he made it clear to both Mr. Hilbury and Mr. Hawkins that he would be using motor-driven machines.

Other evidence was given for the defence to the effect that there was very heavy machinery in the neighbourhood, the working of which could be heard in the street, and that the defendant's electrically-driven machines would make less noise than treadle machines.

Mr. Fortune, in summing up the defendant's case, admitted that there was undoubtedly some noise caused by these machines, but people could not live in a city without having to endure some noise, and he submitted that the noise in question fell very far short of a common-law nuisance.

His Lordship, in giving judgment, said that there had not been the slightest evidence put before him that the negotiations for the agreement of tenancy proceeded on the footing that the defendant was to be entitled to use power-driven machinery on the premises, and he was satisfied that the plaintiffs' agents never had it brought before them that it was the intention to use such machinery. The onus of showing that his business could not be carried on without causing a nuisance was on the defendant, and he had not only not established that proposition, but had not attempted to do so. He had come to the conclusion that the working of these machines was a nuisance, though he thought it was just on the border line of what was a common-law nuisance, and he accordingly granted an injunction to restrain the defendant from so working his machines as to cause a nuisance, and awarded the plaintiff Barzalia £15 by way of damages

The defendant was ordered to pay the costs of the action, but the injunction was suspended for four weeks to enable the defendant to get out of the premises.

The defendant's counterclaim was dismissed, with costs.

Cunningham, Ltd.

The petition of W. T. Henley's Telegraph Works, Ltd., for a compulsory order to wind up Cunningham, Ltd, electricians, again came before Mr. Justice Astbury, in the Companies' Winding-Up Court, on Tuesday. Counsel reminded his Lordship that at the previous hearing he stated that a few creditors had not come into the arrangement that had been proposed. He was now able to state that the whole of the creditors had come in, and the only thing to do now was to dismiss the petition by consent, without costs.

Mr. H. E Wright said he appeared for a large number of creditors opposing the petition and he assented.

His Lordship dismissed the petition, without costs.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Variable Speed A.C. Commutator Motors.

Messrs. F. Parkinson & Co., of Wells Works, Guiseley, near Leeds, have recently issued a new catalogue and price list of their A.C. commutator motors, an installation of which at the Government Stamp Printing Works, Hayes, Middlesex, was described in the Electrical Review, of November 21st, 1913. The makers claim that these are the only British-made motors in which the following features are obtainable: (*a*) A large speed variation, up to a ratio of three to one, with a shunt speed characteristic throughout the range; (*b*) this is obtained without the use of any resistances; (*c*) efficiency practically constant at any speed, and comparable with that of a D.C. motor of equal size. The motors have fixed brushes and no mechanical governor or short-circuiting device of any description is employed.

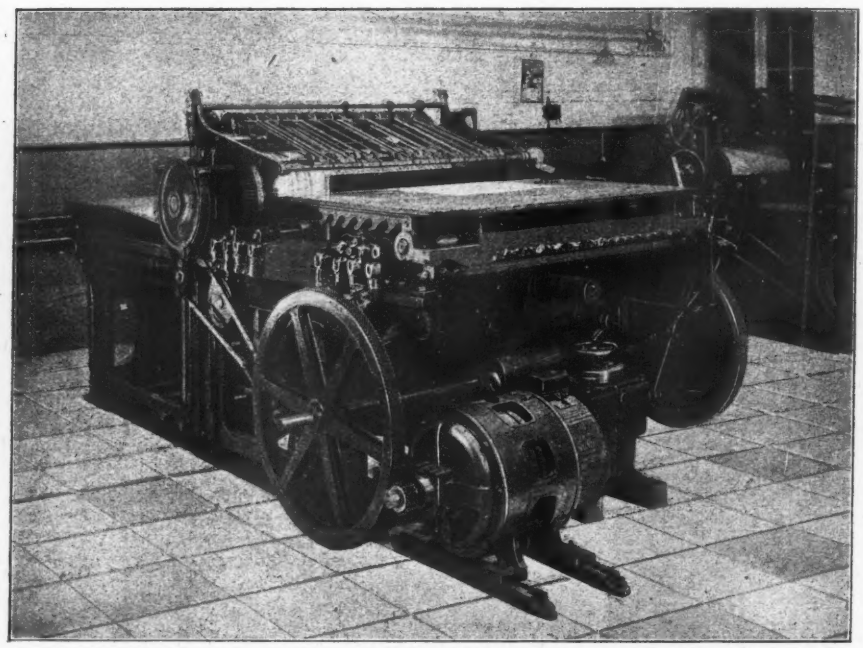


Fig. 1.—Variable-Speed A.C. Commutator Motor Driving Printing Press.

The motors are provided with exceptionally robust shafts, bearings and commutators, which ensure great reliability in service, and have been designed in five types, covering practically the whole field of the application of alternating-current motor driving for industrial purposes. We illustrate in fig. 1 a variable-speed single-phase motor driving a printing press. The speed controller consists of a small oil-immersed transformer which is shown in the illustration. These machines are built under the Punga and Creedy patents.

A serious objection to alternating-current commutator motors in the past has been the difficulty of obtaining satisfactory commutation. This feature has received very careful consideration in the design of the Parkinson motors, and the makers can guarantee the commutation to be equal to that of the best modern direct-current practice. These motors fill a long-felt want in the application of alternating current for industrial purposes.

The firm have recently completed a large extension of their works in order to meet the increasing demands for their manufactures, and the whole of their works is devoted to the manufacture of alternating-current commutator motors.

The Firadanac Mining Switchgear.

Messrs. Berry, Skinner & Co, of 78, Upper Thames Street, London, E.C, have brought to our notice a new type of explosion-proof switchgear, consisting of a very compact form of combined fuse-switch specially constructed for use in those regions of the coal mine where the Home Office Regulations require the apparatus to be explosion-proof, and preferably fool-proof.

It is conceded by experts that an apparatus which has its component parts in one chamber is better and safer than an apparatus which separates its switches and fuses into different compartments connected by small inlets; moreover, a combined apparatus of the fuse-switch type is obviously more compact, and for a given output has a less cubical content for the retention of explosive gases. It is claimed that the present invention contains a number of points, all important, but never hitherto combined in one piece of apparatus.

The following are the features of the Firadanac explosion-proof, interlocked combined fuse switch with air-break, to which attention is directed:—

Great mechanical strength; exceptionally small size for a given output; wide machine-faced surfaces in comparison with the cubical contents of the cabinet; every current-carrying contact is renewable from the front; by an ingenious mechanical device the movable switch contacts can be revolved to present an entirely clean switch contact after damage; every switch is arranged so that the current is broken upon each pole, upon two contacts in series, and with a parallel action. This is better than a knife-switch with one, or even two, contacts where the current is broken at a point; it is impossible to tamper with the contacts by mischief or accident; the switch has positive quick make-and-break action; access to the explosion-proof cabinet is impossible until the moving switch contacts and fuses have been made dead; the design is arranged so that the mains may enter at either the top or bottom of the cabinet, and without having to turn the switch "upside down"; the apparatus is fitted with Berry's patent magnetic blow-out fuses. Without a screw-driver or any other tool, these can be re-fused with ordinary copper wire in a few seconds. There is no possibility of accidental shock during replacement.

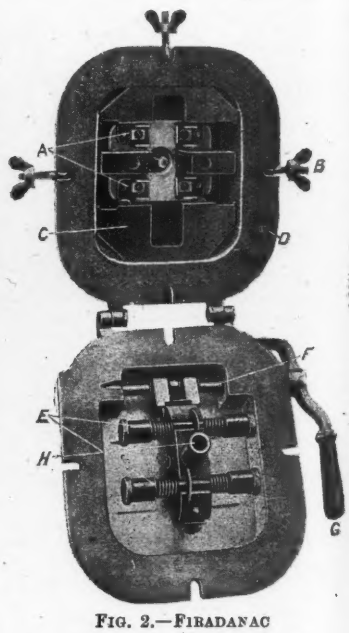


Fig. 2.—Firadanac Switch-fuse, Box Open.

The switchgear was examined and tested by the Underwriters' Laboratories, Inc., of Chicago, U.S.A., in December last. A sample 20-ampere 200-volt switch was operated 12 times by hand, closing and opening a circuit in which a continuous current of 30 amperes at a pressure of 315 volts was passing, first with the switch cabinet earthed, and afterwards with the generator alternately earthed on the positive and negative side. Strips of copper were placed in parallel with the fuses to prevent the latter from blowing. The contacts were only slightly burned.

The insulation resistance was measured with a 500-volt Evershed Megger, and the result was:—Positive to negative, 20 megohms; positive to negative to earth, seven megohms. The two poles of the same switch were connected to the terminals of a transformer, and starting at 800 volts the pressure was gradually raised to 2,000 volts and maintained for one minute. The test was repeated with the transformer terminals connected to the switch contacts and metal case respectively. The insulation satisfactorily withstood this test. The illustration (fig. 2) shows an ironclad fuse-switch cabinet with the cover open; this cabinet is provided with a 1½-in. machined flange D, with similar provision on the hinged cover. When the cover is closed and the metal surfaces are together, they are clamped by four equally-spaced wing nuts as at B.

The cover having been closed, the lever G can now be operated by means of the spindle and rock shaft F to throw the rapid-acting toggle joint carrying the magnetic blow-out fuse carriers E into their respective base contacts at A. This operation of closing the switch automatically locks the cabinet by means of the engagement of a male bolt in the centre of the base with the female projecting tube H. It is impossible to open the cover until the bolt is withdrawn by moving the switch to its "off position."

Shrouding of the cable connections in the base to meet the Home Office requirements is provided by the insulating screens as

Fig. 3.—Firadanac Switch-fuse, Closed.

at C. To rewire a blown fuse, the magnetic blow-out fuse carriers E can be out-sprung in one second, re-fused and in-sprung into position in under 30 seconds for the complete operation. The apparatus is low in price and simple in construction. Every part is interchangeable; it is "made like a gun."

Electrically Heated Grip for Steering Wheel.

Electrically heated leather-covered grips for use on steering wheels of automobiles, have been developed by the Interstate Electric Co., New Orleans, La. The grips are attached to the wheel, as shown in the accompanying illustration, and are

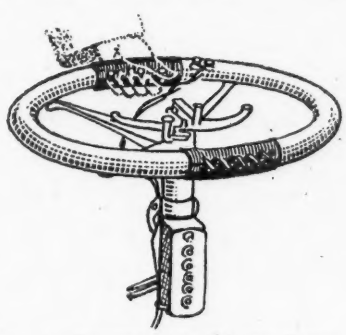


Fig. 4.—Electrically Heated Grips.

provided with laces for making them tight. Energy may be obtained from the storage battery of the car, or, if the magneto's rating is high enough, from the magneto.

Shop Window Reflectors.

A complete series of seven shop window reflectors has been brought out by the General Electric Co., Ltd., of Queen Victoria Street, E.C., which includes the following types: Shell, fluted scoop, plain scoop, hemispherical, horizontal parabolic, vertical parabolic, conic, all of which (except the hemispherical) are made in two sizes, the smaller designed for up to the 30-watt Osram

Fig. 5.—G.E.C. Shop Window Reflectors.

lamp size, and the larger for lamps up to the 60-watt size, thus ensuring any pear-shaped Osram lamp of the usual sizes having its correct reflector. All these reflectors have scientific contours, and effectively screen the light from the eyes of persons looking in the shop window.

Special care has been taken to see that the shade carrier ring, which holds the reflector in position, is easily accessible, and a special feature in the case of the deep conic and vertical parabolic patterns is the provision for the necessary ventilation. The high-class nickel plating finish assures the maximum amount of reflection being obtained.

A neat folder, No. F. 1,902, gives particulars of these reflectors, some of which are shown in fig. 5, in tabulated form.

ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The report of the Committee of the above Institution for the year ended December 31st, 1914, was adopted at the annual meeting, held at the Institution of Electrical Engineers, on Monday evening. Dealing first with financial matters, the Committee says that for the second year in succession the principle of having the head of a large firm as President of the Annual Festival resulted in a most satisfactory addition to the funds. The total income from contributions for 1914 was £3,139. This, added to the receipts from dividends and other sources, produced a total income of £3,380, as compared with £1,363 in 1913. The subscriptions from members and the number of members have again increased. The result of the year's work has been a net income of £3,127. The following investments have been made out of this sum:—£404 Canada 4 per cent. registered stock, £407 3 per cent. Metropolitan Water Board stock, £925 New Zealand 3½ per cent. inscribed stock, £1,071 Bombay, Baroda and Central Indian Railway capital stock, = £2,807, bringing the total of the invested funds to £7,727.

For the sixth year in succession a donation has been received from the Electrical Engineers' Ball. Mention is made of the financial and other support received from the electrical Press, and this year for the first time from the general Press.

The working expenses have naturally, in view of the large amount collected, been heavier, but it is a matter of satisfaction that the percentage of the expenses to the amount collected is very much less than in previous years.

The total amount paid out for temporary relief during the year was £253, as compared with £154 in the previous year, the number of grants dealt with being 28. Every person who has applied and who was qualified for assistance received the same.

Employment was found for many of the applicants. The committee has always endeavoured to find work if possible for those who apply for assistance, and in this way the amounts expended on temporary relief are much smaller than they otherwise would be, with the result that the invested funds can be increased more rapidly than otherwise would be the case.

The committee feels that it cannot too strongly impress upon all those connected with the electrical industry how desirable it is that the members of the staffs of firms should join the Institution as members, and it therefore again points out in the report the advantages of membership. It is hoped that the heads of electrical businesses will bring this matter before the members of their staff.

Mr. Hugo Hirst was elected President of the Annual Festival, 1914, and owing to his untiring energies preceding the festival he was able to announce at the dinner that a total sum of over £2,700 had been collected. The chairman's list amounted to £2,464.

The Chairman in his appeal at the dinner was ably supported by Sir David Salomons, Mr. Wordingham (Vice-President of the Festival), and Mr. Godfrey Isaacs, and as the result, the total amount collected in connection with the festival, exclusive of the subscriptions of new members who then joined, was £2,741.

The benefit which has resulted to the Institution by the system of collectors' books is demonstrated by the list in the year-book. The committee trusts that those gentlemen whose names appear in the list, and who devoted so much time and energy during the year 1914 to assist the collection of funds of this Institution, will continue their much appreciated efforts in the year 1915.

The Institution of Electrical Engineers is thanked for the use of its premises, and the electrical Press for its assistance in the matter of publicity.

The balance sheet shows that the fund now has £7,727 invested, and £199 at the bank, with £22 standing as sundry debtors, = £7,948. The income of the year from all sources, including dividends on investments (£225), subscriptions, donations, and sale of tickets, etc., for the Annual Festival Dinner, was £3,470. The expenditure was as follows:—Printing, postages, stamps and stationery, £64; secretary's salary and commission and office expenses, £179; 28 grants paid (ranging in value from £1 10s. to £20), £253; cost of Annual Festival Dinner, £100; making the balance carried to the balance sheet £2,875.

Among those present at the meeting were Messrs. E. Garcke (in the chair), Justus Eck, F. B. O. Hawes, H. Bevis, F. H. Nalder, H. Oppenheimer, A. A. Campbell Swinton, and L. G. Tate. The total income for the past year amounted to £3,470, compared with £1,362 for 1913, and 28 grants, totalling £252, were made, as against 14 grants costing £153. The total out-

goings were £595 (£400), and the surplus carried to the balance sheet £2,874 (£962). The total capital of the Institution on December 31st last was £7,871, against £4,996. At present there are about 170 members. Messrs. Sugden and Hextall were re-elected hon. solicitors, and Messrs. Price, Waterhouse and Co. hon. auditors. Lord Vaux of Harrowden, Lt.-Col. H. M. Leaf, and Messrs. Guy Burney, H. Bevis, H. H. Berry, F. J. Walker, R. J. Wallis-Jones, and S. D. White were re-elected to the committee of management, and it was resolved that special effort be made to induce Mr. E. J. Clark to withdraw his resignation, owing to the valuable services he had rendered in the past. It is desired to fill vacancies on the committee by representatives of electrical firms.

WAR ITEMS.

Carlisle Supply Men.—The following is a complete list of employés of the Carlisle electricity department now serving with the Colours; these form 35 per cent. of the total. Those still employed are provided with a badge indicating that they are engaged on public service.

Baynham, H. P., station superintendent, Royal Engineers.
Hay, J. H., chief clerk, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Fraser, W., storekeeper, 7th Batt. Border Regiment.
Stephens, G., assistant storekeeper, Border Depôt.
Thompson, W. V., consumers' assistant, Army Service Corps.
Ballantyne, H. S., switchboard attendant, 4th Batt. Border Regiment.
Fairclough, F., meter reader, 4th Batt. Border Regiment.
Mannion, J., jointer, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Baxter, R., stoker, 2nd Batt. Border Regiment.
Berry, M., coal trimmer, 4th Batt. Border Regiment.
Wright, A., coal trimmer, Royal Engineers.
Clark, W. H., porter, 4th Batt. Border Regiment.
Sanderson, R. H., engine room attendant, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Simpson, J., apprentice, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Todd, G., apprentice, 4th East Lancs. Howitzer Brigade Cumberland R.F.A.
Gem, R., apprentice, Royal Engineers.

Germans and Russian Cables.—According to the *Novoie Vremya*, the subscription of the house of Bogau & Co., of Moscow, of 300,000 roubles for war charities, has brought the question of the nationality of the house under discussion. It is undoubtedly considered to be German, and two members of the board, M. Ph. and G. M. Mark, only became naturalised Russians after the war began. Further, after the outbreak of the war, a syndicate was formed in Petrograd called the United Cable Factories Co., in which the chief part is played by the house of Bogau, along with the German house—Felten & Guilleaume, of Mannheim. This syndicate, says the journal quoted, now dictates the prices of copper and copper products in Russia, being part owner of the Bieloretzk, Kolchugin and other factories which control practically all the copper goods produced. Controlling also rich copper mines of the Caucasus and the Urals, Bogaus dispose of immense stocks of copper, and if the syndicate has raised the price of copper by about 50 per cent., and of copper goods by 75 per cent., the lion's share of the profit is passing into the pockets of Messrs. Bogau & Co.

A Hungarian Company and the War.—The report for 1914 of the Hungarian Felten & Guilleaume states that after a short period of stagnation the industrial and economic life of the country assumed a regular course with the exception of a few branches. Instead of a dearth of work a scarcity of workers had arisen, and the difficulties resulting therefrom, as well as from the limitation in the production of coal and the increased cost of manufacturing, brought about a diminution in the profits. The gross profits amounted to £37,000, as compared with £41,000, and the net profits were £17,000, as against £28,000 in 1913, the dividend being 10 per cent. as contrasted with a rate of 15 per cent. in the previous year. At present the company is still engaged directly and indirectly on the execution of war orders and would be able to keep the works in full operation were it not for the lack of copper owing to the requisition of this material by the Government.

English Capital in Germany.—The chairman of the Mix and Genest Telephone and Telegraph Co., of Berlin, was asked at the recent general meeting why the company had registered a proposal for the liquidation of the Lampson Co., in which the former is financially concerned. In reply it was mentioned that the telephone company was at present unable to work with an undertaking in which Englishmen were interested, which was now everywhere exciting attack, and was excluded from official orders. After the removal of the English participation it was added that the Lampson Co. would presumably resume business activity, and the hope was expressed that favourable results would then be obtained.

More Electrical Men Wanted.—The 204th Field Company R.E. and 40th Divisional Signal Company R.E. are now being formed and training at Norbury, S.W. Major Minshall, R.E., M.I.E.E., is in command of the 204th Field Company. There are vacancies in both of these companies for electricians, wiremen, telegraphists and mechanics. Applications for particulars or for enlistment should be made to the Norbury Golf Club House, Norbury, S.W.

Board of Trade Assistance.—List No. 16 (week ending April 10th) has been issued giving particulars of inquiries received for sources of goods by the Commercial Intelligence Branch of the Board of Trade.

Municipal Repair Shops.—The Manchester civic authorities are making every effort to assist the Government in increasing the output of war munitions, and on Friday a special sub-Committee of the Corporation Electricity Committee offered the War Office the use of the repair shops at the Stuart Street generating station. This is a large building, containing lathes and other important machinery. The War Office representatives in the city have expressed the opinion that the building is most suitable for the work.

The Liverpool Tramways, Electric Power and Lighting Committee has passed a resolution that the Committee desires to do everything possible to assist the Government in the production of munitions of war, and that the Corporation workshops at Lambeth Road be placed at the disposal of the Government for this or for any other purpose, such as repairs to motor transport vehicles, &c.

Contravening Lighting Orders.—The first prosecution in Leeds for contravention of the Military lighting restriction orders, under the Defence of the Realm Act, occurred last week, when a tradesman was fined £10, with the alternative of eight weeks' imprisonment. When the defendant said he would pay in a week the Stipendiary Magistrate said he must pay that day or go to prison. The defendant had defied the police.

Personal.—Mr. J. H. Thomas, A.M.I.E.E., who has recently returned to England from the Far East has been granted a commission in the Royal Engineers, and is attached to the 204th Field Company now training at Norbury.

Mr. E. A. Shaw, formerly assistant engineer to the Burton-on-Trent and Ashby-de-la-Zouch Light Railway Co., has been gazetted Lieutenant in the Royal Garrison Artillery.

By wireless from Berlin comes the information that the Iron Cross has been conferred upon Prof. Roentgen in acknowledgment of his eminent services to surgery. The professor was decorated on his 70th birthday.

The *London Gazette*, on Tuesday, contained the following announcements:—

TERRITORIAL FORCE.

No. 2 Electric Lights Companies.—Neville L. Phipps (temporary) Cyril R. Norman (temporary).

No. 3 Electric Lights Companies.—Percy H. Bartlett (temporary), Cuthbert L. Fox (temporary).

No. 4 Electric Lights Company.—George Frederick Bale to be Second Lieutenant. Dated April 21st, 1915.

London Electrical Engineers.—Second Lieutenant Hubert F. G. Roose is seconded. Dated April 10th, 1915.

Roll of Honour.—Information has reached Liverpool that two more tramway men employed by the Corporation have been killed at the front. The roll of honour of the tramway staff is now 17 killed and 40 wounded out of 1,000 men.

Information has reached Eccles of the death of Private E. Ashton, of the 2nd Batallion Lancashire Fusiliers, who was shot though the head by a German sniper. He was a single man, and for 17 years had been employed in the electricity department of the Eccles Corporation.

Sergt. Fred Helm, who was employed in the shipping department of Messrs. Dick, Kerr & Co., Strand Road, Preston, has been killed in action. The deceased, who was 29 years of age, has left a wife and three children. He was recently awarded the D.C.M., and promoted sergeant. He had seen service in India and South Africa.

Corporal A. E. Irving, of Burnley, a local tramway conductor, has been awarded the D.C.M. for his work in the Neuve Chapelle fighting. He is 27 years of age.

Private C. J. Husband, aged 20 years, Pendleton, formerly employed by the British Westinghouse Co., has been invalided home, suffering from the effects of rheumatic fever, which he contracted through exposure in the trenches.

Private Thos. Herbert Hilton, 3rd Border Regiment, of Oldham, has been killed in action. He was 24 years of age, and was formerly employed as a conductor on the Oldham Corporation Tramways. He was killed on April 10th, as his Quartermaster reports—"while doing his duty bravely and nobly." Private Foster Irving, 1st Manchester Regiment, who was also a tramway conductor at Oldham, was shot in the head and killed while going to the trenches on April 7th. He had been through the battle of Neuve Chapelle.

Second-Lieut. Sidney Gudgeon, of the Manchester Regiment, recently reported as having been wounded in France, was for three years a student in the Manchester School of Technology (Faculty of Technology of the University), where, in 1912, he was awarded the Certificate of the University in Electrical Engineering.

"Noise and Vibration caused by Electric Plant."—With reference to the case reported under this heading in our "Legal" section last week (page 545), a correspondent informs us that the nuisance really arose from the noise created by the exhaust from a gas engine driving the electric lighting plant at the picture palace. The writer is anxious that electrical plant should not carry a burden of blame which properly belongs to gas.

THE CASE FOR THE ELECTRIFICATION OF ENGINEERING WORKS.

By ERNEST P. HOLLIS, A.M.I.E.E., A.Amer.I.E.E., M.Assoc.Min.E.E.

For very many years the opponents of the electrification of engineering works have sought to make out their case on the ground of low power costs. It will be within recollection that some years ago almost every railway station in the country was placarded with announcements by firms of gas-engine makers containing the legend "10 B.H.P. for 1d. an hour." Possibly under exceptional circumstances such a claim could be justified; indeed, if it came to be a question of low power costs, the writer could point to a case in which, by the introduction of electrification, a large works is obtaining the whole of its power at a cost of minus £1 a week. For some time electrical engineers found it difficult to make headway against these assertions, and then only by forcing upon the owners of engineering works a realisation of the large losses incurred in line shafting. Before the introduction of the electric motor little care had been bestowed on line shafting, but electrical engineers soon showed that there were exceptional cases in which 60 per cent. of the total power generated by the engine was wasted in the shafting, and 30 per cent. was a common figure. This appreciation of heavy line-shafting losses led to a number of conversions to electric drive.

Later on, when factories grew larger, a further disadvantage of a drive from long lengths of shafting demonstrated itself. The engineer could not say: "I will put my machine here because it is the best place for it," but had to say: "I cannot put my machine here, although I would like to, because it would be too costly to bring up the line shafting; therefore, I must go near to the line shafting."

With increasing competition and the necessity for an intelligent arrangement of the machinery so that work went orderly through the shops and never had to retrace its steps, the engineer began to chafe at the restrictions imposed upon his arrangements by the line shafting, and to look more favourably upon the electric drive, even though its opponents had asserted that it cost slightly more per B.H.P.-hour than other methods of drive. In consequence, he first of all electrified a few outlying machine tools without committing himself to the larger scheme of electrification advocated by electrical engineers, and he experimented with these tools. He found that, contrary to what he had been told, they needed no experts to work them, and that the operations involved in the control of the motor were so simple that they could be safely entrusted to the machine operator. At the same time he succumbed to the temptations of the small electric tools which were pressed upon him, and found, no doubt to his surprise, that an extremely large number of operations which had hitherto involved great labour and inconvenience could be performed by handy little electric drills, grinders and similar machines. He experienced for the first time what a convenience it was in the case of heavy work to be able to take the tool to the work instead of the work to the tool. Probably he was still unconvinced that he had not done all that he could do towards the improvement of the driving of his factory. He was still under the impression that as long as he did not press the extension of the line shafting too far he was not incurring undue losses; at any rate, he was not incurring losses greater than manufacturers of the gas, steam or oil engine told him would be incurred in the transformation of the energy in the steam, gas or oil to electricity and transmitting it and subsequently converting it to mechanical power. But sooner or later he was persuaded by the electrical engineer to test the power taken by the shafting running light and under other conditions, and to compare it with an individual drive. How was he to do it? Obviously, responded the electrical engineer, by installing temporarily an electric motor and measuring the power taken by the motor. The experiment showed that the electrical manufacturers were right. The line shafting often took an excessive amount of power to drive it, even on light load, and there was a great waste of power in keeping the whole of the shafting going when, perhaps, only one machine was required to be run. A few further tests demonstrated that the aggregate power required by individual electric motors was less than had to be applied at the central point for driving through a line of shafting.

But this experiment brought home to him something about the electric drive that he had not appreciated before. For the first time he could conveniently measure the power taken by a machine. For the first time he could say whether that machine was taking more power than the manufacturers had asserted. For the first time he was able to make adjustments in the running of the machine, and able to tell whether those adjustments resulted in an increase or decrease in the amount of power consumed.

With the introduction of the new steels with high cutting speeds, he found that his existing power arrangements were inadequate to run the machines under their new conditions. He experienced difficulties in the cutting of metals of varying degrees of hardness due to the slipping of the belts and the poor speed regulation. It was then not long before the advantages of the electric drive in respect of speed control were brought home to him.

Of course, one of the best canvassers for electrification in engineering works has been the electric crane. Every engineering works of any size employs electric cranes which have often been installed before the conversion of the main drive to electricity.

The foregoing remarks have outlined the different steps involved in the education of the factory owner to the advantages of the electric drive, and up to the present only the main benefits accruing from electrification have been discussed. These are now fairly widely appreciated amongst factory owners, and it is practically only in those few cases where the owner himself is interested in the manufacture of prime-movers suitable for driving from a central point, that the consumers' engineer will find any antagonism to the electric drive. There are, however, numerous points which can be brought home with advantage to assist a consumers' engineer in the securing of new consumers, and an endeavour has been made below to set out briefly telling points which can beneficially be put before potential consumers.

Elimination of Line Shafting Losses.—The elimination of line shafting losses has already been discussed. A consumers' engineer has, of course, to make sure of the extent of line shafting in the works before he can use this argument. In very small works it is sometimes the case that a central drive would not be greatly inconvenient, and in these instances the argument of the elimination of line shafting losses carries no weight.

Tools Worked to their Maximum Output.—The factors which enable an individually-driven tool to be worked to its maximum output are:—

(*a*) The overload capacity of the motor.

(*b*) Better speed regulation, permitting metals of varying degrees of hardness being treated at different cutting speeds.

(*c*) The absence of slipping belts.

(*d*) The ability to make rapid starts, stops and reversals.

(*e*) The ease of control from convenient points.

(*f*) Independence of auxiliary details.

Free Arrangement of Tools.—It is of great importance in a modern engineering shop that there shall be the fullest freedom in the arrangement of the tools, not only to enable the work to be carried through the shops in the best sequence of operation, but to permit the changing of the machine tools for larger or different ones.

Provision of Facilities for Adding New Tools.—It often happens in laying out an engineering shop that it is not possible to foresee the extent or the direction of the developments of the work. A new class of work comes along; a greater demand for a particular class is experienced than had been anticipated; or the demand for certain articles has not realised expectations. In any of these contingencies it may be desirable to introduce new tools or to transport older ones, thrown into desuetude through lack of work, to another part of the shop. When tools are tied to the line shafting, the rearrangement or the introduction of new tools is a matter of difficulty, and the convenience of being able to put down a tool where one likes without any consideration of line shafting is a matter of great moment.

Ability to Measure Power.—One of the greatest advantages introduced by electrification is the great ease with

which power can be measured. Not only can the power taken by the machine on full load be ascertained and adjustments made which permit a reduction in the amount of power without any effect upon the quality or quantity of the work, but the light load readings can be taken, which offer a reliable criterion of the mechanical efficiency of the tool, and any deterioration in the gears or other defects can be instantly detected.

Facilities for Overtime and Week-end Work.—In many industries repairs and maintenance work is carried on during the week-end; indeed, in textile mills and in several other works the writer has visited, special engines have been installed to save the main engine being run during the week-end. The disadvantages of having to keep an engine-room and boiler house staff in attendance either during overtime or at the week-end in order that one or two small machines can be run for repair work are so obvious as to make it not worth while to pursue them further.

Elimination of Belts.—Probably in very few engineering works would it be possible or economical entirely to eliminate belts; but by electrification the number can be considerably reduced. Some belts are advantageous in the respect that they form an admirable friction clutch, but they have their many disadvantages, which are well known; while, in addition, there is the cost of maintenance.

In a big engineering works, belt-driven from long lengths of shafting, the handling of work is made considerably more difficult.

No Restrictions upon Head Room.—Electrically-driven cranes are a *sine quâ non* in all engineering works of any magnitude, and anything which interferes with rapid and efficient transport of work about the shops is a decided disadvantage. Line shafting and belts often interfere with the transportation of work.

Increased Safety to Operators.—An individual motor drive affords the fullest protection to the operator; he has only to move a switch. An individually driven machine is in no danger of being started up unexpectedly by the creeping of belts from loose to tight pulleys, the sticking of clutches, and the starting up of line shafting. The tool setter is protected against the inadvertent starting of a machine, and by taking out the motor fuses, assurance can be made that no unauthorised person can start up the machine. Lastly, the operation of belt changing, which has been a source of many accidents, is eliminated.

Non-Obstructed Lighting.—The output of a modern factory is considerably influenced by the lighting conditions. Consciously or unconsciously a workman works much better in a properly-arranged light. That light must not be too strong and not too weak, and the moving shadows which are thrown by belts are a source of great annoyance. As illuminating engineers will know, a works full of belts and shafting offers some trying problems in illumination.

Improvement in Environment.—The elimination of noisy belts and shafting brings about an appreciable improvement in the surroundings. Distracting noises due to belts and shafting are absent, and the workman can concentrate more fully on his work. The incessant din of belts and shafting is not conducive to good workmanship, and with the electric drive the workman does not stand in the midst of a mass of overhead revolving pulleys, moving belts and noisy transmission, permeating the atmosphere with oil spray and dust. Many manual operations, such as belt changing and replacement, are entirely eliminated, and these, in conjunction with other advantages, materially add to the improvement of the lot of the workman.

The foregoing discussion of the merits of the electric drive covers engineering works in general, and there must be in each case special advantages peculiar to the industry itself. As an example of these, the writer was recently visiting a works in which steam haulage had been employed. The steam engine had been replaced by an electric motor. On examining the setting of the relays of the motor, the writer noticed with surprise that although the motor was of 150 H.P., the relays were actually set for 100 H.P. On making inquiries as to the reason for this, he was told that the tubs had to be drawn round a number of difficult curves, and with the steam haulage when the tubs came off, as they frequently did, the track was badly damaged. But with the electric haulage the power they required had not been so great as had been anticipated, and they set the relays to such a low point that the slightest disarrangement in the trucks tripped the relays. In this way the relays which normally are introduced to protect the motor, were utilised to protect the mechanical side of the transportation scheme; and the electrical engineer said that this one advantage alone decided him in favour of electric haulage in all circumstances.

In conclusion, the writer would warn consumers' engineers, if they need any such warning, of the difficulties of dealing with the very small consumer. The man who has a small works driven from a small town gas-engine is very hard to convince. It is of no use attempting to show that for small consumers with power at 1d. per KW.-hour and gas at 1s. per thousand cb. ft., the electricity bill will be smaller than the gas bill. Possibly it will not. Such a consumer counts for nothing the time lost in starting the gas-engine in its recalcitrant moments; he takes no account of the labour involved in its cleaning, or of the time he has to keep it going to run, say, a small lathe after the whole of the other tools in the shop have been shut down, or of the space taken up in his shop by the gas engine plant. It is bad business to convince such a man against his will and then for him to find that electrification is costing him more. Rather is it advisable to deal frankly with him and tell him that under the circumstances electricity cannot compete with the gas; but, nevertheless, there are a number of uses to which electricity could be put in his shop, such as driving portable drills, and so forth. With these he can take advantage at least of some of the benefits accruing from electrification, and when the time comes for an extension of his works his past experience with electricity will incline him towards it, even if he is aware that his electricity bill will be slightly larger than a gas bill.

BUSINESS NOTES.

Osram "Atmos" Lamps. — The General Electric Co., Ltd., announce that owing to continued progress in the manufacture of Osram gas-filled lamps, a name has been registered for this class of lamp. In future all Osram half-watt lamps will be marked "Made in England. Osram Atmos type, Patent G.E.C."

Stoker Contracts.—Messrs. E. Bennis & Co., Ltd., report that the ordinary commercial demand for their machine-stokers, coal elevating and conveying plant has been thoroughly well maintained. A list of contracts recently received covers a very wide range of industries, Corporation electricity stations coming an easy first. We select the following typical examples:—

Nobel's Explosives, Ltd., Powder Factory, South Wales (per Messrs. Yates and Thom).—Thirty-two coking stokers and furnaces for 8-ft. diameter Lancashire boilers.

Manchester Corporation Electricity Department, Bloom Street Station.—Relinking two pairs of chain-grates of another make with the Bennis patent long-life-link. (Repeat order.)

Ditto, Stuart Street Station.—Relinking four chain-grates of another make with the Bennis patent long-life links. (Repeat order.)

Huddersfield Corporation Electricity Station.—Four pairs of chain-grate stokers for Stirling boilers.

Burton-on-Trent Corporation Electricity Station.—Two sprinkler stokers self-cleaning compressed-air furnaces. (Repeat order.)

Coventry Corporation Electricity Station.—Eight chain-grate stokers for B. & W. boilers. (Repeat order.)

A railway company's power station.—Two sprinkler stokers and compressed air furnaces. (Repeat order.)

Pritchetts & Gold, Dagenham, Romford (per Stirling Boiler Co.).—Two chain-grate stokers for Stirling boilers.

Blackpool Corporation Electricity Station.—Bucket elevator with cast-iron receiving hopper and discharge shoot. This plant consists of a bucket elevator to raise 10 tons of coal per hour and deliver it in an overhead bunker with a capacity of 170 tons of coal. As the coal passes from the bunker it will be weighed in an automatic weighing machine and delivered into the mechanical stoker hoppers. The bunker is to be built out of reinforced brickwork and concrete.

The Dowson & Mason Gas Co., Ltd., Alma Works, Levenshulme, Manchester.—Coal and ash-handling plant for India. This plant consists of a Bennis bucket elevator and U-link chain conveyor for receiving the coal from the ground level and delivering it into hoppers for a range of gas producers at the rate of 10 tons per hour. The ashes are withdrawn from underneath the producers, and trimmed by hand into an ash elevator, which raises them into an overhead ash storage bunker, from which they fall by gravity into railway trucks.

The Consolidated Diesel Works. — The *Financial Times* understands officially that a sale has been completed of the Ipswich works of the Consolidated Diesel Engine Manufacturers, Ltd., for the winding up of which an order was made on July 7th last. The purchasers are Messrs. Vickers, the well-known armament and engineering company.

For Sale.—The Manchester Guardians have for disposal one 36-I.H.P. vertical Marshall & Sons' steam engine, driving by belts; one 20-KW., D.C. generator at 205 V.; and one 3-KW. booster at 75 V. Tenders by May 6th. Particulars are given in our advertisement pages to-day.

Book Notices.—*Key to the London Telephone Directory.* Vol. II, No. 1. London: Stone & Colquhoun. Price 2s. net.—Knowing a person's telephone number, but not his name, the difficulty of finding out who he was without ringing him up and putting the question to him was practically insuperable until this useful "Key" was published; for who would essay the stupendous task of hunting through the pages of the Telephone Directory for the number referred to? However, nowadays it is a simple matter. With the aid of this key, one not only finds at once the whole of the numbers at each exchange brought together in consecutive order, but also, in this new edition, besides the page, the column in which each number will be found is indicated. Where more than one use the same telephone number, each has a separate entry. A new edition will be published immediately after each official Telephone Directory. This is emphatically a case of a want well filled. A buyers' guide forms an appendix to the Key.

Submarines, Torpedoes and Mines. By W. E. Dommett. London: Whittaker & Co. Price 1s. net.—This is an excellent little book for the general reader who wants to know something about the construction and operation of the "submarine vessels" referred to in the title. It is not so technical as to present difficulties to the layman, and, on the other hand, it is sufficiently technical to appeal to the engineer. It does not contain much matter relating to the electrical equipment, though this is indispensable to the operation of submarines, which present a notable example of the use of storage batteries for the production of large powers, and are equipped with gyro compasses and other motor-driven appliances, and electric cooking apparatus, as well as wireless telegraph installations in some instances. We can recommend the book as both timely and interesting.

"101 Successful Selling Suggestions" is the title of a little brochure issued free to its 1,233 members by the Society for Electrical Development, of New York; it is claimed to be entirely different from anything ever published before, and to contain ideas which have been selected from 750 that were offered (and paid for at the rate of $1 each). The cost of production has exceeded $1,000. The items cover a wide range of subjects, and in many cases naturally the proposals are not adapted for use in this country; but there is no doubt that many useful hints can be picked up from the booklet, and that where they are not directly applicable to our conditions they contain food for thought, which may lead to profitable results.

Annuaire pour l'An 1915. Paris: Gauthier-Villars & Cie. Price 1 fr. 50 net.—The *Annuaire* of the Bureau des Longitudes for this year contains a mass of tables relating to geography, metrology, astronomy, &c., physical and chemical data being reserved for next year. A special article by M. G. Bigourdan deals with the methods of testing mirrors and lenses exhaustively.

Liquidations—The Chinnery Engineering Co., Ltd. (late the Chinnery Signs (1909), Ltd.).—A meeting will be held on May 18th, at Essex Wharf, Durward Street, Whitechapel, E., to hear an account of the winding up from the liquidator, Mr. H. D. Sheldrake.

Spanish National Submarine Telegraph Co., Ltd.—Particulars of claims must be forwarded by May 31st to the liquidator, Mr. J. Jeffery, at 106, Cannon Street, E.C.

The Consolidated Diesel Engine Manufacturers, Ltd., Aldwych, W.C.—Last day for proofs for dividend, May 4th. Liquidator, Sir W. B. Peat, 11, Ironmonger Lane, E.C.

Catalogues and Lists.—Electrical Alloy Co., Morristown, New Jersey.—Leaflets relating to "Calido" and other resistance materials for electrically-heated devices, instruments, &c.

Messrs. Ferranti, Ltd., Hollinwood.—Binder containing eight new lists describing and giving prices, code-words and weights, for their various types of C.C. ampere-hour meters for house service.

The Electric Suction Cleaner Co., 56, Victoria Street, London, S.W.—Folder giving particulars and prices of the Frant "Premier" electric suction cleaner.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—Three catalogues of specialities made by Ing. Luigi Magrini, of Bergame, for low and high tension overhead construction, also switches and circuit-breakers. Mr. Braulik has secured the sole selling rights for these manufactures, and will be pleased to send copies of the catalogues, all of which are fully detailed in the French language and illustrated, to parties interested.

Messrs. Reavell & Co., Ltd., Ranelagh Works, Ipswich.—Leaflets Nos. 69 and 70. The former illustrates and describes a small air compressor, which was originally designed for starting gas and oil engines, and the latter a type of machine for much higher pressures (1,000 to 1,200 lb. per sq. in.), for filling the receivers for starting Diesel engines. We understand that there is a demand for these machines in other fields; for instance, the No. 69 is serving well in public or private garages for pumping up motor-car tires, and is also used for many other purposes where small quantities of air up to pressures of 250 lb. per sq. in. are required. Both of these types of machine are constructed to be independently driven by an electric motor or by a paraffin or petrol engine.

We have just received from the General Electric Co., Ltd., a useful piece of topical advertising literature, which takes the form of a tough paper folder measuring only 5 in. × $3\frac{1}{16}$ in. when closed, and having the whole of the interior (10 in. × $6\frac{1}{2}$ in.) devoted to illustrations and descriptions of German and British aircraft. The letterpress is confined to the question of distinguishing different machines. Copies of the folder can be obtained on application to the company's publication department, 67, Queen Victoria Street, E.C. Two of the illustrations show respectively a fleet of aircraft dropping bombs, and the other a "Freezor" electric fan providing a refreshing breeze. The words applying to the latter are "Keep cool in case of a heat wave," and to the former "Keep cool in case of an air raid."

Messrs. Credenda Conduits Co., Ltd., Chester Street, Aston, Birmingham.—Descriptive circular detailing the "Credenda" system of electric heating and ventilating as installed at the premises of the company's London agents, 219, Tottenham Court Road, W.C.

Messrs. Bagshawe & Co., Ltd., Dunstable Works, Dunstable.—Illustrated circular relating to their "B. B." chain, and showing views of the works.

Prices Advance.—The Walsall Electrical Co., Ltd., announce that owing to the increase in cost of production they have withdrawn all outstanding quotations as from April 21st for small meters, and that their prices will be increased by 20 per cent. from that date.

Bankruptcy Proceedings.—W. Walker (D. Smith and Co.), dealer in electric lamps, formerly of 2 and 3, Red Lion Court, Fleet Street, E.C., but whose present business address cannot be ascertained.—Trustee, Mr. E. S. Grey (Official Receiver, Carey Street, W.C.), released March 25th, 1915.

C. Wray, mechanical and electrical engineer, Bradford.—Last day for proofs for dividend May 1st. Trustee, Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford.

G. J. T. J. Parfitt.—At the Bristol Bankruptcy Court on Friday last, bankrupt, an electrical engineer, examined by the Official Receiver, stated that he had filed an amended statement of affairs, showing gross liabilities, £4,973; deficiency, £2,616; assets, £1. He commenced business in Denmark Street in 1888 with his brother, as Parfitt, Webber & Co. They paid £320 for the business, and subsequently he and his partner put into the business further capital to the amount of about £2,600. In 1912 his partner went to South Africa, and the business was made over to the Colston Electrical Works. In consideration he received £1,650 in £1 ordinary shares. The primary reason for selling the business was to compensate his sister in respect of a guarantee to the bank for £300 which she had been asked to pay off. He entered into a contract to supply electrical fittings, plant, and buildings to the Bristol International Exhibition for the pageant. He made a net loss of £25 in respect of the contract, and he owed £95 for goods in respect of it. He did not supply goods to the Exhibition, but his loss was for work done as consulting engineer. The main cause for his failure was the failure of the exhibition company, of which he was a director without fees or salary. He had charge of the electrical installation, and all exhibitors had to take current from him. He expected to make £1,000 profit. He held £750 first debentures, £710 second debentures, and £271 ordinary shares. A judgment for £551 was obtained against him in respect of guarantees. Since the war began his trade had been cut off, and he estimated that he had lost orders to the amount of £2,500. The examination was adjourned until May 14th.

J. W. and T. W. Tattersall (Tattersall & Tattersall, electrical engineers, Willesden, N.W.).—An application for debtors' discharge will be heard on May 11th at Carey Street, W.C.

Russia.—A large Russian technical agency office in Moscow, which has hitherto dealt exclusively with Germany, desires to represent United Kingdom manufacturers of centrifugal pumps, electric motors, &c. Inquiries should be addressed to the British Consulate-General at Moscow.

Trade Announcements.—Mr. L. H. Parker, formerly with the General Electric Co., of America, and for the last 10 years with the Stone & Webster Engineering Corporation, has been appointed President of the Spray Engineering Co., of Boston, U.S.A., which company has sent us bulletins dealing with its equipment for cooling condensing water and air washers for turbine generators.

Premises at Beehive Corner, Cranbrook Road, Ilford, have been opened by Messrs. Bowes & Co., electricians.

The Argentine Republic.—There was a very heavy decline last year in the importation of electrical goods into the Argentine Republic, the official returns lately to hand showing a total of only £1,405,000, as contrasted with £2,022,000 in 1913.

LIGHTING and POWER NOTES.

Barking.—Price Increase.—The U.D.C. has decided upon a temporary increase of 10 per cent. in the charges for current, except in the case of power users consuming over 8,000 units per month, when the increase is to be at the rate of 5 per cent.

Barnsley.—Proposed Extensions.—The borough electrical engineer has prepared a scheme of proposed extensions at the electricity works.

Bolton.—L.G.B. Inquiry.—An inquiry was to be held this week into an application for sanction to borrow £45,033 for the purposes of the electricity undertaking.

Arbroath.—Public Lighting, &c.—The T.C. is to experiment with gas and electricity for street lighting. Recently the Lighting Committee resolved to ask the Gas Works Committee to state at what figure it could supply gas lighting if necessary, and if thought advisable, to take the place of the present electric lighting of the streets, and the Council has decided to test the two systems.

A Sub-Committee is to meet representatives of the Arbroath Electric Light and Power Co. in regard to the assessments on the electric mains; the company holds that the assessment should only be charged on one-fourth of the valuation instead of the full rates being charged, and points out that there is a charge of £43 for water assessment on the mains while the company paid direct for all water consumed by it. If the Council will strike out the assessment of £43, the company is prepared to settle rather than have any further dispute over the matter.

Bedford.—Power Supply.—The T.C. has decided that current for power and lighting combined supplied to manufacturers taking 300,000 units and above per annum, shall be charged 1d. per unit, subject to a scale of discounts for prompt payment of accounts, varying from a deduction of 2 per cent. for a load factor of 12 per cent. or over, to 20 per cent. for a load factor of 20 per cent.

Boston.—E.L. Scheme.—The R.D.C. has consented to the application of Mr. R. A. Smith for a prov. order for electric light at Skirbeck, Fishtoft, Freiston, Skirbeck Quarter, Wyberton, Frampton and Kirton, but the order, by arrangement with the B. of T., is not to take effect until after the war, to prevent capital being locked up in private enterprise.

Carlisle.—Civic Opening of Extensions.—At the ceremonial opening of the electricity works extensions by the Mayor, Mr. F. P. Dixon, which took place recently, the visitors, under the guidance of Mr. Fredk. W. Purse, the city electrical engineer, made a general inspection of the works, visiting the new buildings, where the recently installed plant was set in motion by the Mayor. His Worship also formally unveiled a brass tablet commemorating the occasion. Afterwards the company adjourned to the showroom, where Mr. Gibbings, who presided, said it was interesting to know that the output in units in 1913-14 was 3¾ millions, and this year they hoped to record four millions. As an indication of the greater efficiency of modern plant and machinery, the engineer told them when the extension scheme was fully completed they would have 17 times the original capacity, at only five times the cost; he concluded by proposing a vote of thanks to the Mayor and Mayoress for their attendance, and by presenting the Mayor, on behalf of Messrs. J. Laing & Son, the building contractors, with a handsome silver table lamp.

Mr. J. W. Nicholson, deputy-chairman of the Electricity Committee, seconded the vote of thanks, which was supported by Mr. J. W. Laing, and Mr. P. N. Rand of the British Westinghouse Co.

Sir Benjamin Scott presented Mr. Gibbings with a gold bracelet watch for Mrs. Gibbings on behalf of the British Westinghouse Co. He did not think the public had realised the value of the electricity works, or that by the establishment of this undertaking the Council had appropriated to itself the whole of the motive power of the city.

Mr. J. C. Dove, the first chairman of the original Electric Lighting Committee, seconded the motion, which was supported by Mr. James Morton, one of the leading manufacturers of the city, and Dr. Overton, an ex-chairman of the Electricity Committee.

Castlewellan.—Street Lighting.—The *Belfast News Letter* says a further conference in regard to public electric lighting has been held, when a proposal by Messrs. Curran Bros. to supply and light 30 street lamps at £1 each per annum, provided the local people subscribe £500 in 6 per cent. preference shares was favourably received, and arrangements are to be made to give the necessary security. A generating station is to be erected.

China.—The China papers state, according to *Eastern Engineering*, that the Chefoo Electric Lighting Co. has commenced supplying current to consumers in Chefoo. The plant consists of two complete sets of 100-kw. alternators, consisting of two three-phase, 50-cycle, 3,300-volt alternators; two Belliss compound engines; three Babcock-Wilcox boilers; two Belliss jet condensers and pumps; two boiler-feed pumps, purifier and heater combined, and the necessary switchboard.

Clifden (Co. Galway).—Prov. Order.—The B. of T. has issued a provisional order, to be included in a confirmation Bill, authorising the Council to supply electrical energy in its administrative area.

Continental Note.—Germany.—As was expected, the Berlin City Council has resolved by a large majority to municipalise the works of the Berlin Electricity Works Co. on October 1st of this year, and has sanctioned a loan of £6,500,000 for this purpose. A scheme for the organisation of this department is to be submitted at an early date.

Cuba.—The following persons have been granted permission to install electric power and lighting plant in Cuba:—Senor Francisco Arredondo y Bentancourt, at Jobabo, in the municipal district of Victoria de las Tunas; Senor Dorindo Vazquez, in the town of Florida, province of Camaguey; and also Senor Perfecto Rodriguez, in the town of Florida. The *Gacetas*, which contain particulars regarding the installations to be carried out, may be consulted at the Commercial Intelligence Branch of the B of T.

Dublin.—Committee of Inquiry.—The Corporation has appointed a Special Committee to inquire into, and report upon, the administration of the electricity undertaking, the prices charged for light and power, the number of engineers and workmen employed, salaries and wages question and conditions, procedure in purchasing coal, and charge for interest on and repayment of moneys borrowed.

Dundee.—The electricity department is running the risk of being seriously hampered on account of the large number of enlistments from the staff. Up to date there have been 72 enlistments, and other men are on the point of joining the Army. It was stated that Lochee sub-station has already been shut, and if more men go away further curtailment will be necessary. It is pointed out that the department may be unable to supply the foundries and jute establishments engaged in pressing Government work. The Committee has decided to ask the Government for an exemption for the staff still at work.

Edinburgh.—Coal Contract.—A local paper states that the electricity department's coal contracts for the coming year have been settled, including some 25,500 tons for McDonald Road station, and 15,000 tons for Dewar Place station, bought at prices which represent an increased cost of £10,000 on the previous year.

Featherstone.—The U.D.C. has withdrawn its objections to the Bill of the Yorkshire Electric Power Co., and, in consequence, the district will be retained in the company's schedule.

Glasgow.—Showroom Proposals.—With reference to the proposal to open a permanent showroom for electrical appliances, to be equipped and managed entirely by the Corporation, on the lines mentioned in our issue of March 26th, page 459, agreement has now been reached, and the proposals submitted to the T.C. for approval. The original clauses in the proposal have been slightly modified, and the fourth paragraph now reads:—"That all fittings, accessories, lamps, and apparatus sold from the showroom shall be at the usual trade selling prices, such prices to be the usual current prices of the firms supplying goods to the showroom (originally list prices were mentioned). The fifth paragraph, which stated that, as far as possible, sales initiated in the showroom should be completed through the contractor, &c., has been deleted, and the seventh paragraph now states that the hiring of apparatus shall not be undertaken from the showroom "in the meantime," &c., the latter words having been inserted.

Haworth.—Prov. Order.—A prov. order for E.L. has been granted to the U.D.C.

Heywood.—Plant Extensions.—The T.C. has approved of revised estimates, submitted by the electrical engineer for extensions as follows:—Buildings and plant, &c., £4,135; overhead mains and auxiliary plant, £2,600; total, £6,735.

Irlam.—Prov. Order.—The B. of T. has issued a prov. order authorising the Council to supply electricity for lighting and motive power purposes.

Itchen.—The U.D.C. has passed a resolution consenting to the prov. order for E.L. being applied for by the Southampton T.C. in respect of the parish of Bitterne, for which the laying of mains in a portion of Itchen is necessary, on condition that the mains to be laid will not affect in any way any of the rights of the U.D.C. under the E.L. order of 1913.

Kingstown.—The U.D.C. has appointed Mr. J. P. Tierney, of Dublin, as consulting engineer in connection with the electric lighting scheme for the district, at a fee of 5 per cent.—*Freeman's Journal.*

Llantarnam.—Proposed E.L.—The Highways Committee has had the question of E.L. referred to it, as the result of an offer from the South Wales E.L. and P. Co. to give a bulk supply.

London.—St. Pancras.—Life of Half-Watt Lamps.—The Electricity Committee recommends that the electrical engineer be authorised to carry out the scheme submitted by him for the substitution of half-watt lamps for 172 open-type arc lamps. The Committee reports that an experimental circuit of 14 half-watt lamps has been in operation for the past 10 months in George Street and Gower Street, and has proved successful. These lamps have burned for nearly 3,500 hours without a breakage, although only guaranteed for 800 hours. Taking as an estimate 2,000 hours' burning, the engineer estimates a saving of £132 per annum in maintenance charges; the estimated cost of the proposal is £500.

Loughborough.—The Corporation has, says the *Sanitary Record*, installed at its gas works a De Brouwer electric stoking plant and an electric coke conveying telpher.

Newcastle-under-Lyme.—The T.C. has been informed by the L.G.B. that the loan of £1,250 applied for for mains extensions cannot be granted. The Council had accepted the tender of Messrs. Callender, at £1,240, for the mains, and it was stated at a meeting on April 14th that the firm was prepared to adhere to this price, and to carry out the work when the war was over.

Newport.—A South Wales paper says that the proposal of the E.L. and Tramways Committee to increase the price of energy on account of increasing costs was adopted by the T.C.

Normanton.—Prov. Order.—The B. of T. has granted a prov. order authorising the Council to supply electrical energy for public and private purposes.

Oldham.—Mill Driving. — The Highfield Mill Co., North Moor, has decided to install electricity for driving purposes in substitution for steam driving.

Rochdale.—A Curious Complaint.—Among those who complained to the Rochdale police in respect of the cutting off of the electricity supplies last Saturday was one gentleman who had a curious grievance. At the time the current was cut off, he explained, he had a large number of eggs in an incubator, and the shutting off of the warmth led to the eggs going cold and becoming spoiled.

Rochester.—Refuse Destructor. — The T.C. has decided to inform the Chatham T.C. that it does not see its way to fall in with a suggestion that it should join in a scheme for the provision of a joint refuse destructor for the two boroughs.

Stanley (Yorkshire).—Prov. Order.—The B. of T. has granted a prov. order to the Electrical Distribution of Yorkshire, Ltd., authorising the latter to supply electrical energy for public and private purposes within the urban district.

Stockton Heath.—The P.C. has agreed to the terms of the Warrington Corporation relative to the proposed area of electricity supply, and to support the application provided certain clauses are included in the proposed Order.

Stone. — Gas and Electricity Purchase. — The U.D.C. is, according to the *Journal of Gas Lighting*, considering the purchase of the local gas company's undertaking, which also embraces electricity supply, and has offered £35,000.

Sunderland.—War Bonuses.—At the T.C. on April 15th, several Committees proposed that a bonus be paid, the total involving £9,000 a year. In the case of the Electricity Committee, it was agreed that the bonus should be 3s. with wages up to 50s. a week, and in the case of the tramways 2s. up to 50s.

Swinton and Pendlebury.—Street Lighting, &c.—The U.D.C. has decided that from April 1st the price to be charged for electricity for street lighting be reduced from 1¼d. to 1d. per unit.

During the past year the amount of energy generated at the electricity works was 351,116 units, an increase of 93,471 on last year.

Truro. — E.L. Scheme. — The T.C. having asked whether, in view of the refusal of a loan for carrying out the E.L. scheme, it is tied by the stipulation that the compulsory works should be carried out within two years from the issue of the order, which period expires next August, the B. of T. has replied that it has no power to extend the time embodied in the order, which will remain in force notwithstanding any default in respect of compulsory works until it is revoked by it.

Tynemouth.—The Electricity Committee proposes to charge those consumers whose accounts are on a net basis, 5 per cent. extra for current supplied, and to return such additional 5 per cent. as discount, provided the account is paid with the ordinary period allowed for discount.

Waterford.—L.G.B. Inquiry.—The date fixed for the inquiry into the Corporation's application for a loan of £30,000 for its electric lighting project is April 27th.

Wells (Somerset).—E.L. Scheme.—At the monthly meeting of the City Council, a letter was read from the solicitors of the company which proposed to supply electricity to the city, stating that it had been decided, in view of the present national crisis, to withdraw the city of Wells from the proposed order.

West Hartlepool.—Proposed Loan.—Application is to be made for sanction to cover the necessary expenditure for extensions of mains and services for the use of customers, and for the purchase of a water softening apparatus.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—A demand for an increase in wages of 1d. per hour for employés earning 6½d. per hour and under, and of ½d. per hour for those in receipt of 7d. and over, has been made by the Aberdeen tramway men. The T.C. has offered a war bonus of 2s. to all with less than 30s. per week, the wages with bonus not to exceed 30s. per week.

Barnes.—The L.G.B. has notified the Council that, in view of the desire of the Treasury to restrict expenditure, it would not be able to authorise the loan for the purchase of electrically-propelled dust vans at the present time.

Birkenhead. — Rate Relief.—The Tramways Committee has decided to apply the sum of £1,260 to the relief of the rates. In previous years the available surplus has been transferred to the renewals fund, which at the close of the year amounted to £21,955. The Electricity Committee does not anticipate being able to afford any balance to the district rate.

Glasgow.—Female Conductors.—Everything points to an extension of the experiment with women as car conductors, to fill vacancies caused through shortage of male labour on the tramway system. The general manager, after reporting on the earlier observations made in the limited experiment with two women conductors, received sanction to extend the scope of the experiment for further information, and on Tuesday (April 13th) a special tuition-car was run over representative routes of the city and district system. The only passengers carried were eight women aspirants for the posts of conductors and an inspector, who initiated the ladies into the actual work of car conducting, including the selling and punching of tickets. According to the *Telegraph*, the manager has been instructed to engage as many additional women as conductors as may be required; the number is understood to be nearly 400, and a wage of 27s. a week, with uniform, is offered.

On Saturday the services of the eight women conductors enabled the department to run as many extra cars—the women conductors being left with the sole responsibility.

The Tramways Committee has remitted to the general manager for consideration and report, a letter on behalf of the Paisley District Tramways Co., intimating in connection with the renewal of the agreement for the running of the Glasgow Corporation cars from Hawkhead Road to Paisley Cross, that it could not agree to an allowance of 15 per cent. on the present rate per mile to meet working charges, and suggesting 10 per cent. as a sufficient allowance.

Heywood.—Year's Working.—Subject to audit it is reported that the loss on the working of the Corporation tramways for the 12 months will amount to about £1,042, as compared with a profit a year ago of £85. The war is largely responsible for this adverse result.

Hull.—Electric 'Bus.—According to a Yorkshire paper, Ald. Meyer recently stated in the T.C. that an electric 'bus would be put on the Leeman Road for experimental purposes.

The question of the Hull Road tramways is under discussion in view of a letter from the L.G.B. in regard to prospective expenditure.

The Corporation has had under consideration the situation created by shortage of men on the tramways. The drivers and conductors voluntarily agreed to work overtime to the extent of 12 hours a week if necessary, for the period of the war. They were willing also to work for double pay in lieu of taking their week's holiday.

Ilford.—The U.D.C., at a meeting last week, continued the debate on the motion of Councillor Bailey, that in view of the financial condition of the tramway undertaking, the best available expert advice be called in to assist the Council in formulating a scheme by which the undertaking can be placed upon a sound commercial basis. Replying to various criticisms, Councillor Bailey said that the Council had not accepted the manager's advice, and was apparently taking upon itself the responsibilities of experts. Had not the payment of £2,500 out of the reserve in relief of the rates been made some years ago, the reserve to-day would have been quite £10,000. After discussion an amendment was carried instructing the Tramways Committee to consider the advisability of obtaining expert advice to assist the Council.

Leeds.—Year's Working.—The annual accounts of the tramways department for the year ended March 31st last, showed total receipts £433 939, as against £427,455 in the previous year. After deducting £115,601 for traffic expenses, £40,347 for general expenses, £43,609 for repairs and maintenance and £28,577 for power, the gross surplus to carry forward to net revenue account is £205,805, which compares with £201,073 for the previous year. The net surplus available for the relief of rates is £81,567, as compared with £70,004 last year.

London.—St. Pancras.—The L.C.C. has informed the B.C. that it is not prepared to accept its offer at the present time to supply energy to the Council's tramway department for the ensuing six summer months.

Manchester.—War Bonuses.—At a conference of tramway men on the 14th inst., the decision of the City Council to grant a war bonus of 2s. to all employés earning 30s. a week and under was discussed. It was decided to send a resolution to the Council, regretting that the recommendation of the employing Committee was not given a more favourable consideration. The recommendation of the Committee was that all employés earning up to 40s. should receive the bonus.

Rate Relief.—At a meeting of the Manchester Tramways Committee, on Tuesday, it was agreed to give £100,000 in aid of the relief of the rates for the ensuing year. Prior to this result being announced, some doubt had existed as to whether the department would be able to keep up its contribution at last year's rate of £100,000—a figure to which it is pledged for a further year.

Musselburgh.—The T.C. has decided to insist upon the Musselburgh Electric Tramway Co. putting its track in better order, the burgh surveyor having reported that the track between Loretto and Levenhall was in a serious state of disrepair.

Newcastle.—The B. of T. having called upon the Corporation Tramways Committee to release as many men as possible in order that they may be employed on the manufacture of munitions of war, the situation was considered by the employés at a meeting on Sunday. It was decided to raise no objection, providing that the men who leave and go into the factories shall be guaranteed reinstatement at the end of the war, and that their work in the factories shall count as tramway service. The introduction of women to fill their places was not objected to, provided that the women join the Union and are not underpaid.

At a meeting of the T.C. on April 14th a deputation attended from the tramwaymen and informed the Council that the ballot of the men had resulted in an almost unanimous rejection of the Council's war bonus offered at the last meeting. The Tramway Committee is to report on the matter.

Radcliffe.—During the past year the Radcliffe tramways sustained a loss of £820.

Reading.—War Bonuses.—At the recommendation of the Tramways Committee, the T.C. has agreed that all employés of the tramways department, other than motormen and conductors, shall receive a war bonus of 3s. per week, or such part thereof as shall bring their wages to 34s.; motormen and conductors to receive a bonus of 6d. in addition to their increase of 2s. 6d.

Wigan.—War Bonuses.—As 25 per cent. of the men employed by the Tramways Committee of the Corporation would not benefit by the Council's war bonus scheme, application is being made by the local officials of the Tramway and Vehicle Workers' Association for a reconsideration of the claim of increased wages. Failing this, the men ask for a war bonus of 2s. a week, for all employés over 21 years of age, and 1s. per week for those under the age.

TELEGRAPH and TELEPHONE NOTES.

Canada.—The annual report of the Marconi Wireless Telegraph Co. of Canada states that the company now operates, in all, 40 stations in the Dominion, in Newfoundland, and in Labrador. Ninety-three steamers of Canadian register are equipped with the Marconi system. With the completion of the duplex system the Louisberg trans-Atlantic receiving station has been brought into operation, in addition to the installation of high-speed transmission at Glace Bay.

Telephone Progress.—The *Telegraph and Telephone Journal* for April points out that while in Germany the number of telephone subscribers has greatly decreased, in this country the number increased by nearly 5,000 during the latter half of 1914, in spite of the disconnection of lines rented by alien enemies. In addition some 4,000 military and naval stations were connected, which are not included in the table given below:—

Telephone Canvassing Results for the Six Months ended January 31st, 1915 and 1914.

	New stations. 1915.	New stations. 1914.	Cessations. 1915.	Cessations. 1914.	Net additions. 1915.	Net additions. 1914.
London ...	11,809	15,700	12,305	8,111	496 (dec.)	7,589
Provinces ...	19,830	27,815	14,459	13,242	5,371	14,573
United Kingdom...	31,639	43,515	26,764	21,353	4,875	22,162

United States.—The accumulated traffic at the Tuckerton, N.J., wireless station has been cleared up, and messages for Germany and Austria-Hungary are being accepted, subject to the former restrictions, including liability to considerable delay.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—June 2nd. Electric lighting material for cars (Contract 28.187). Tender box, Railway Offices, Melbourne. Particulars at Contractors' Room, Spencer Street.* Deposit ½ per cent. of amount of tender.

June 1st.—Deputy P.M.G. Eight miles of paper-insulated lead-covered cable. (Schedule No. 1,184.)*

June 2nd. Bogie trucks, wheels and axles for 10 cars of the St. Kilda-Brighton electric street railway (No. 28,621) for the Victorian Railway Commissioners.*

June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. Mollwraith, McEacharn & Co., Ltd., London, E.C.

Queensland.—June 1st (instead of March 16th). P.M.G. Switchboard for Warwick. See "Official Notices" March 26th.

Sydney.—May 31st. Three electric battery locomotives for Public Abattoirs, Homebush, for the Department of Public Works. Specifications, &c., 5s., from the Accountant, Public Works Department.

June 16th.—Deputy P.M.G. 400 Morse sounders, American pony pattern. (Schedule No. 449.)*

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Aldershot.—May 4th. Steam and other pipework; water-softening plant. See "Official Notices" March 26th.

Dundee.—April 28th. Corporation. Centrifugal circulating pumps, and 750 ft. of 42-in. and 30-in. cast-iron pipes. See "Official Notices" April 9th.

Hendon.—The Guardians are inviting tenders for an electric lighting installation for the workhouse.

London.—Wandsworth.—April 28th. Three months' supply of electrical fittings, &c., for the B. of G. Forms of tender from Mr. F. J. Curtis, Clerk, Union Offices, St. John's Hill, S.W.

Mountain Ash.—April 26th. U.D.C. Sub-station building, E.H.T. underground cables, L.T. overhead lines and public lighting, E.H.T. switchgear, L.T. switchgear and transformers, for Abercynon. See "Official Notices" April 16th.

New Zealand.—Wellington.—Extension of date to May 21st. Public Works Office. A three-unit exciter set (Section 49) and a 1,500-kw. generator (Section 50), for Lake Coleridge power scheme. Specifications and forms of tender may be consulted at the office of the High Commissioner in London for New Zealand, 13, Victoria Street, S.W., and at the Board of Trade Commercial Intelligence Branch in London.

South Africa.—Johannesburg.—June 1st. Municipal Council. 24 double-pole, automatic, oil-immersed circuit breakers of a continuous carrying capacity of 200 amperes (Contract No. 971). Specifications, &c., from the Controller of Stores, Municipal Offices, Plein Square, Johannesburg. Tenders to Town Clerk.—*Board of Trade Journal.*

Spain.—Tenders have lately been invited by the municipal authorities of Noblejas (Province of Toledo) for the concession for the electric lighting of the town during a period of five years.

The municipal authorities of Zahinos (Province of Badajoz) have lately invited tenders for the concession for the electric lighting of the town during a period of five years.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II., Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

CLOSED.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

War Office.

Electric fittings.—Foot & Milne; A. V. Giffkins & Co.
Galvanometers.—General Electric Co., Ltd.; W. G. Pye & Co.; Reid Bros. and Co., Ltd.
Telephone board.—Siemens Bros. & Co., Ltd.
Telephones.—Automatic Telephone Manufacturing Co., Ltd.; Gent and Co.; The New Phonopore Telephone Co., Ltd.; Siemens Bros. & Co., Ltd.
Wire, steel.—British Insulated & Helsby Cables, Ltd.; Connolly Bros., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Siemens Bros. & Co., Ltd.
Electric light installation, Northolt.—C. Cooper & Co.
" " " Ripon.—S. Dixon & Sons, Ltd.
Electric lighting huts, Woolwich.—W. G. Tackley & Co., Ltd.
Electric cranes at Deptford.—Stothert & Pitt.
Electric lifts, Whalley.—W. J. Furse & Co.
Generating station, Ripon.—Stott & Alcock.

Crown Agents for the Colonies.

Telegraph poles.—Siemens Bros. & Co.
Copper wire.—Shropshire Iron Co., Ltd.

India Office, Store Department.

Carbons.—General Electric Co.
Cells.—Siemens Bros. & Co.
Insulators.—Bullers, Ltd.
Platinum.—Johnson, Matthey & Co.
Searchlights.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
Wire.—Callender's Cable Co.; Shropshire Iron Co.; T. Bolton & Sons.

Post Office.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; British Insulated and Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Western Electric Co., Ltd.
Testing apparatus.—General Electric Co., Ltd.
Battery boxes.—Standard Woodwork Manufacturing Co., Ltd.
Electric light cable.—W. T. Henley's Telegraph Works Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telephone cable.—British Insulated & Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Western Electric Co., Ltd.
Compound (chalk, tar and pitch).—Dussek Bros. & Co.
Jointing sleeves (brass).—C. M. Powell Bros.
Insulator spindles.—Bullers, Ltd.
Bronze wire.—British Insulated & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.
Ditto (insulated).—Connolly Bros., Ltd.
Flameproof wire.—C. Macintosh & Co., Ltd.
Ditto (enamelled).—J. C. Fuller & Son, Ltd.
Laying ducts.—Belshill, Motherwell; Siemens Bros. & Co., Ltd.
Laying ducts and pipes.—Jamestown, T. Spence.
Telephone exchange equipment extensions.—Lee Green: Western Electric Co., Ltd. Sydenham; Western Electric Co., Ltd. Willesden; Peel-Conner Telephone Works, Ltd.
Telephone exchange equipment, Wishaw (Glasgow).—Peel-Conner Telephone Works, Ltd.
Provision of a set of accumulators.—Leeds Automatic Telephone Manufacturing Co., Ltd.

H.M. Office of Works.

Renewal of electric cables of Houses of Parliament.—The Western Electric Co., Ltd.
Miscellaneous:—Edinburgh electric bell-hangers' work, Pratt Bros. Electric cable and wire, The Union Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd. Glasgow electric bell-hangers' work, Bennett & Rutherford.

(Continued at page 589.)

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

After briefly outlining the contents of his paper on the above-named subject at the Institution of Electrical Engineers on Thursday last week, Mr. J. H. Rider, M.I.E.E., described the sequence of operations in the gold mining industry with the aid of a number of lantern slides, most of which, thanks to his courtesy, we are enabled to reproduce herewith. The group of mines with which the author has been associated as consulting electrical and mechanical engineer for the past four years crush about 8½ million tons of ore per annum, and produce about 36 per cent. of the total gold output of the Transvaal, or one-seventh of the total gold output of the world. When it was decided, in 1908, that the whole of the power requirements of these mines should be taken from an outside source, a separate supply company, called the Rand Mines Power Supply Co., Ltd., was formed for that purpose. This power company owns the Rosherville and Vereeniging power stations, and the air-compressing station at Robinson Central Deep (a section of Crown Mines, Ltd.).* During recent years electrical power has been adopted for almost all the mechanical operations except rock-drilling, which is done with compressed air mainly supplied from central stations, and, in some cases, the air is compressed by electrically-driven plant; thus the horse-power of the 1,500 motors employed amounts to 142,300 h.p., and the annual consumption of electrical energy to 310 million units, the maximum demand being 47,300 kw. and the load factor 75 per cent. The maximum demand upon the compressed-air system is 37,900 kw., and the load factor 84 per cent.; the consumption is 103 million "air units" per annum, the air unit representing 0·641 of the energy in one electrical unit.

Fig. 1.—City Deep Mines: General View.

The most important service is that of winding, as not only is the output of the mines entirely dependent upon it, but also the safety of thousands of men (both white and coloured) who descend and ascend the shafts daily. There are at the present time 38 shafts in use on the mines of the group, many of which have underground winders for the lower depths, in addition to surface winders. One of the largest of the latter is illustrated in fig. 2.

Fig. 3 shows the headgear of the City Deep Mine, with three hoists; the rock excavated at a depth of over 3,000 ft., when raised to the surface, is tipped into bins over the "grizzlies" seen in the foreground, and is then fed upon broad rubber travelling sorting belts. The function of the grizzlies is to permit the small stuff to fall through, while the large lumps roll over the bars, thus roughly sorting the material in the first instance. Some of the sorting belts are seen in fig. 4; they travel very slowly, and Kaffir "boys" standing alongside pick out the useless rock, which is easily distinguished from gold-bearing ore. The latter passes on to the crushers, which reduce it to pieces not exceeding 1½ in. in diameter. The crushers, shown in fig. 5, are driven directly by electric motors, and owing to their heavy duty give rise to severe vibration; for this reason, as will be seen in the view, their axes are placed at right angles, to distribute the vibration over the whole building. The motors driving the crushers are shown in fig. 6.

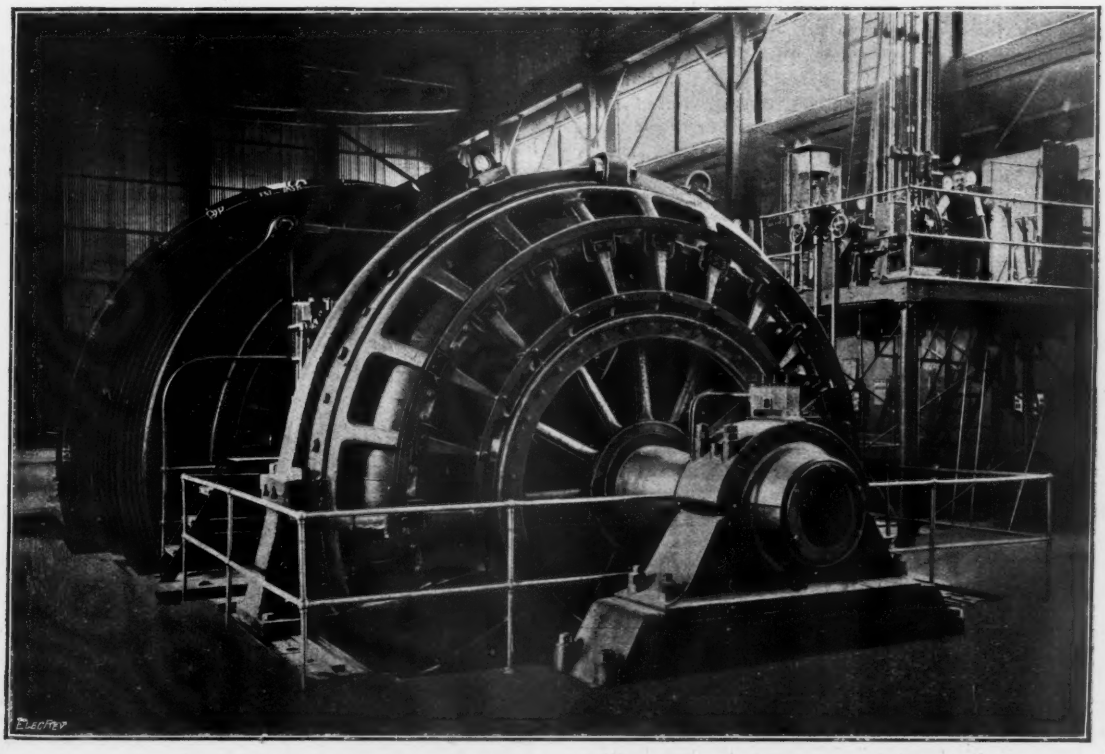


Fig. 2.—Winder driven by two 2,000-h.p. d.c. Motors, at South Rand Shaft, Crown Mines, Ltd.

In the long run, the ore has to be reduced to an impalp-

* For a description of these stations, see Electrical Review, March 28th, 1913.

able powder, in order to enable the whole of the particles of gold to be extracted. The next process through which it passes for this purpose is illustrated in fig. 7, which shows the upper portion of a battery of stamps. These are steel rods shod with stamps at the lower ends, weighing 1,200 to 2,000 lb., and provided with tappets higher up, which, as shown, are lifted by cams mounted on a rotating shaft. The cams are double, so that each rod is lifted and dropped twice in a revolution, and they are arranged so

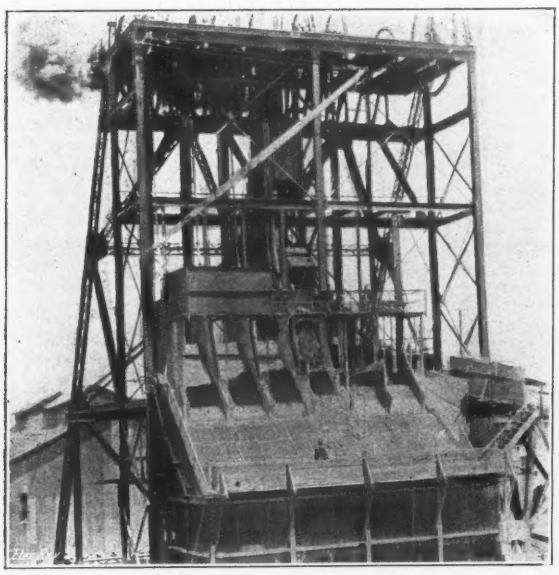


Fig. 3.—Headgear and Grizzlies: City Deep.

that the stamps operate consecutively. A very brief period elapses between the dropping of a stamp, which of course occupies a constant interval under gravity, and its next lifting by the following cam; hence, as Mr. Rider pointed out, a slight increase in the frequency of the alternating-current supply to the driving motors involves a serious risk of "camming," that is, receiving the blow of the stamp on the following cam, with disastrous consequences to the latter. Experience has shown that this danger exists at a speed greater than 98 drops per minute, and it increases with any increase in the speed of dropping.

Having fixed the output of the stamp mill on the basis of 98 drops per minute for each working stamp, while any

Fig. 4.—Sorting Belts: City Deep.

increase in the speed is dangerous, any decrease will reduce the output of the mill in the same proportion. As the variation of frequency permitted by the contract with the supply company is 5 per cent. up or down, this has to be taken into account in settling the speed of the driving shaft. During the early period of the power supply considerable trouble was experienced from these causes, which affected all the mills at the same time. As it was afterwards found that the supply was more generally given at or near the higher frequency, the drives were altered to suit, this being the lesser evil.

At this stage water is employed to wash the crushed rock through screens of small mesh, and the mixture passes on to tube mills (fig. 8), in which it is finally reduced to pulp. The tube mill is a cylindrical steel vessel, like a boiler shell, a common size being about 22 ft. long × 5 ft. 6 in. diameter. It is carried upon hollow trunnions, and is rotated at a speed of about 28 R.P.M. The interior is lined either with hard segmental stone blocks or with concrete in which steel pins are embedded. The crushed ore as it comes from the stamp mill in the form of a coarse pulp is fed through the trunnion at one end, together with a number of small selected pieces of ore, called pebbles, about 3 in. cube, which act as grinders, and themselves gradually become reduced to powder. The finished product comes

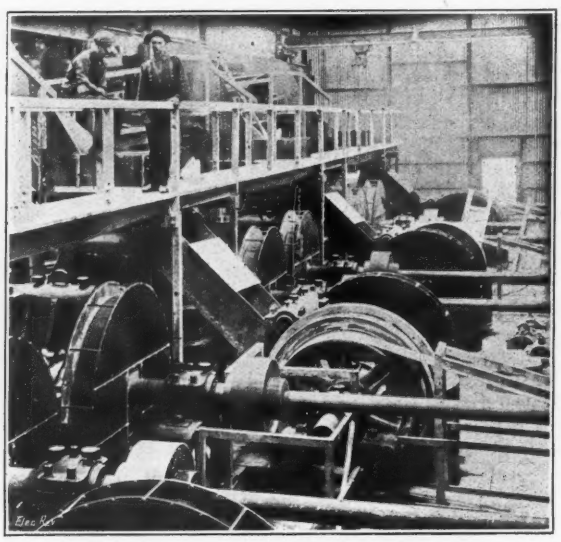


Fig. 5.—Crushers: City Deep.

out of the trunnion at the other end, and is then ready for passing over the amalgam tables.

In fig. 9 are shown motors driving tube mills directly through Citroen spur gearing, with the controlling apparatus on the opposite side of the motor room. The gear ratio, however, was too great for single-reduction gearing to cope with satisfactorily, and in later practice the motors drive countershafts by belt, as shown in fig. 10. The tube mills have a certain amount of end play, so that the gearing should have straight teeth.

The next process is the extraction of the gold, in which

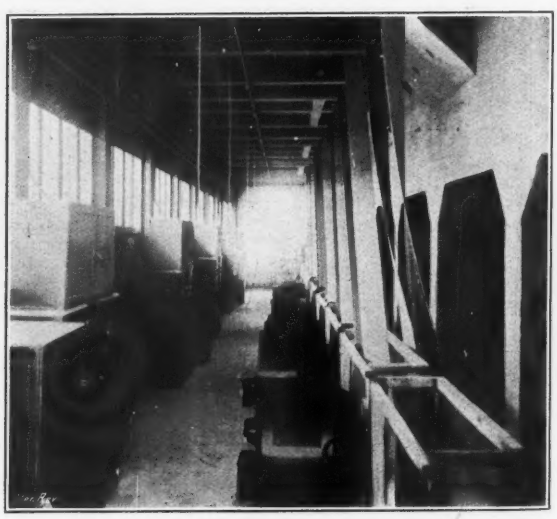


Fig. 6.—Crusher Motors: South Rand.

electricity plays but a small part. The pulp passes over a series of copper tables, shown on the left of fig. 11, the upper surface of which is amalgamated with mercury, and here the greater part

of the gold is trapped. Periodically the amalgam is scraped off, and the gold recovered by vaporising the mercury. The pulp, after passing over the mercury tables, is further treated by the cyanide process in the large tanks shown in fig. 1, to remove the remaining gold as far as possible. The cyanide solution is then carried to the boxes shown on the right hand of fig. 11, where the residue of the gold is precipitated on zinc shavings. The product is then smelted and the gold recovered.

Winding from deep levels on the mines of the group is effected mainly by three-phase induction motors, but in some

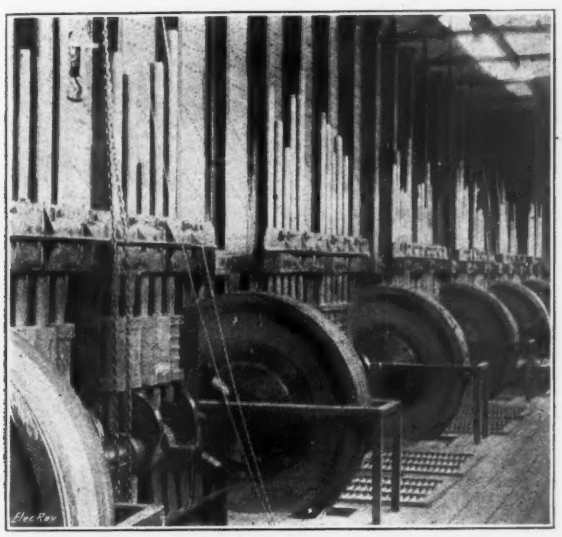


Fig. 7.—Stamp Mill: City Deep.

cases D.C. motors are used on the Ward-Leonard system. The former are controlled by variable rotor resistances, usually of the liquid type, as shown in fig. 13. The electrodes are in the upper tank, and the electrolyte is pumped up by a centrifugal pump, which determines the rate of rise of level, and therefore the acceleration of the motor, independently of the driver. Various troubles have been met with, and successfully overcome, in the operation of these liquid resistances. More recently electrically-operated

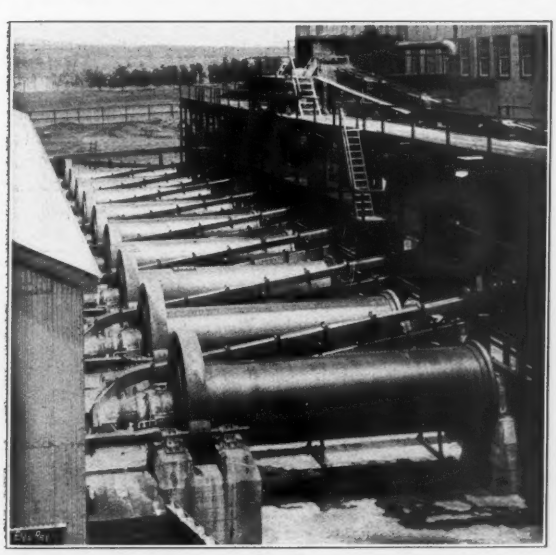


Fig. 8.—Tube Mills: City Deep.

contactor switches have been used in conjunction with metallic resistances, and have given very satisfactory results.

The D.C. motors are controlled by metallic resistances in the field circuit of the generator. One of the latter winders is illustrated in fig. 2, p. 585; this is the largest electric winder in South Africa, and is driven by two motors, each of 2,000 H.P. There are two cylindro-conical drums, each 22 ft. in diameter, which run at 54 R.P.M. and wind a net load of 16,000 lb. from a depth of 3,540 ft. at a speed of 3,500 ft. a minute. There are three of these winders at the South Rand shaft of Crown Mines, Ltd. The motor-generator for the set illustrated runs at 350 R.P.M., and has

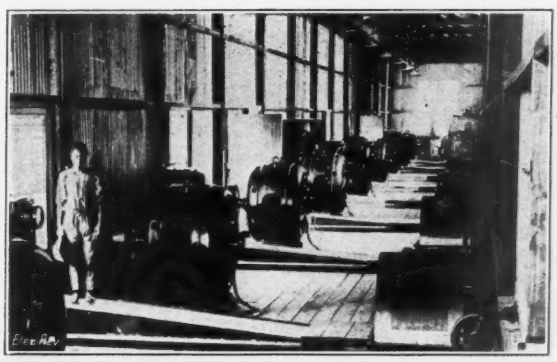


Fig. 9.—Tube Mill Motors (Single-Reduction Drive): City Deep.

two generators, working at 500 volts, which are connected in series with one another and with the two winding motors. The current taking at starting is frequently 5,000 amperes. The electrical equipment was made by the General Electric Co., U.S.A.

While most of the compressed air is supplied by the power

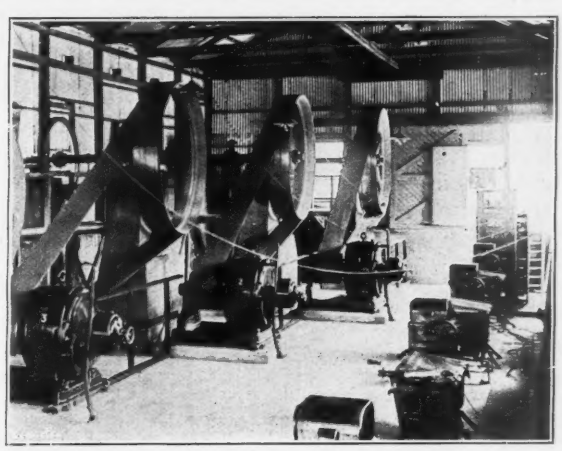


Fig. 10.—Tube Mill Motors (driving through Countershaft): Nourse.

company, four of the mines have their own compressing plant. Fig. 14 shows two vertical two-stage air compressors made by Messrs. Belliss & Morcom, Ltd., and driven by electric motors. In some cases existing steam-driven air-compressors

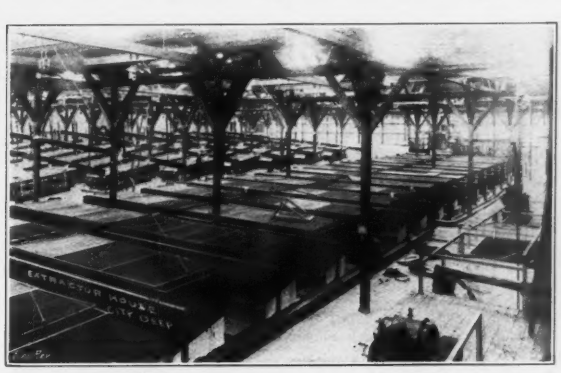


Fig. 11.—Extractor House: City Deep.

have been converted, by grooving the fly-wheel rim for ropes and substituting a motor for the engine (fig. 16).

A direct-coupled compressor at Bantjes is of the high-speed turbine type. It compresses the air up to 7·5 lb. gauge pressure, at which pressure the horizontal rope-driven com-

pressors take it and complete the compression. It was made by Messrs. C. A. Parsons & Co., and has been most successful in operation.

The driving is by three-phase constant-speed motors, and

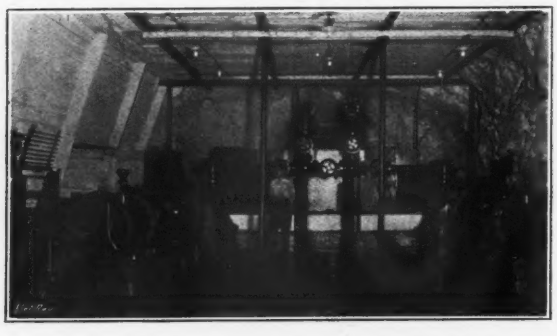


Fig. 12.—Underground Pump Chamber: D. Roodepoort Deep.

the governing is done by butterfly valves in the main suction pipes, which are controlled by the air pressure, and close as long as the pressure in the receiver is above the normal. As soon as the pressure falls the valves open and the compressors work normally.

The system of pumping water from the mines with Cornish pumps in stages of about 500 ft. has been superseded with great advantage by the plan of allowing all the water to gravitate to the lowest level and pumping it to the surface in a single lift. For this purpose motor-driven geared ram pumps were used until 1912, when it was decided to use high-speed multi-stage centrifugal pumps, with direct-coupled motors, at the South Rand shaft of the Crown Mines, Ltd., and at No. 1 shaft, Durban Roodepoort Deep, Ltd. The plant at both mines is identical, and each consists at present of two pumping units.

One of the underground pump rooms is shown in fig. 12; each unit consists of a high and low-pressure Sulzer pump, with the motor between them, and lifts 375 gallons per minute to a height of 2,400 ft. The sets run at 1,470 R.P.M., and take about 500 B H.P. Sets of twice the size are being installed at Crown Mines. The saving in running cost was sufficient to wipe out the whole of the capital outlay in two years. It is not that the centrifugal pump, by itself, has a higher efficiency than the ram pump, but the use of the former renders concentration of large, high-power and high-speed pumping units possible in a minimum of space, with a minimum of attention and very low maintenance costs.

The success of the centrifugal pumping system has been such that large similar schemes are now being considered for other mines of the group.

The power company's electric supply is given at normal pressures of 2,100 volts and 525 volts at the consumers' terminals. Fig. 15 is a view of a switchboard in one of the switch-houses; it is of the cubicle type, built of reinforced concrete, the high-pressure gear being on one side of the switch-house and the low-pressure on the other. Owing to troubles resulting from installing switches rated merely for the full load of the circuits, the author made a rule that all oil-switches in a switch-house should be of the same size, rated for a current of 800 amperes at 15,000 volts, whether used on 2,100-volt or 525-volt circuits, with the result that trouble in switch-houses has practically disappeared.

Three-core, lead-covered and armoured cables, laid in trenches, are universally used between the main switch-house and the various sub-distribution points on each mine. The points are arranged to suit the local conditions, and

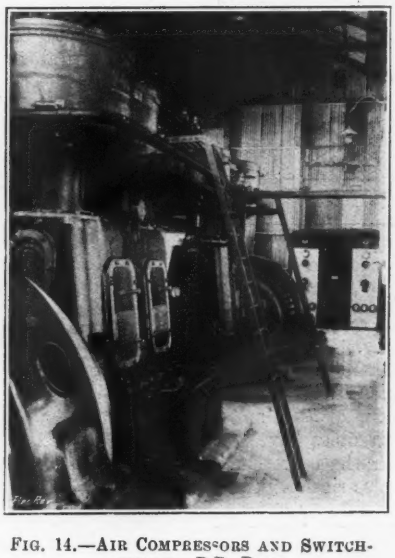


Fig. 14.—Air Compressors and Switchboard: D.R. Deep.

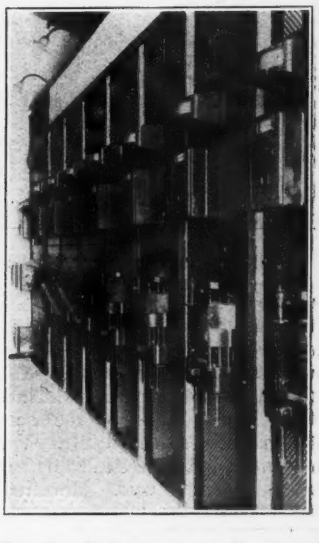


Fig. 15.—Switchgear in Switch-house: D.R. Deep.

are generally interconnected, so that the failure of any main cable does not stop the supply. Link cages, without switches, are provided at the sub-points, so that the sub-circuits can be isolated at any time and the feeders interconnected as may be required.

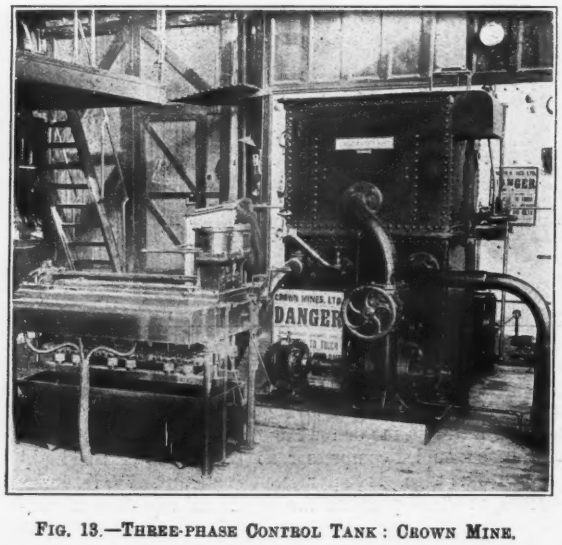


Fig. 13.—Three-phase Control Tank: Crown Mine.

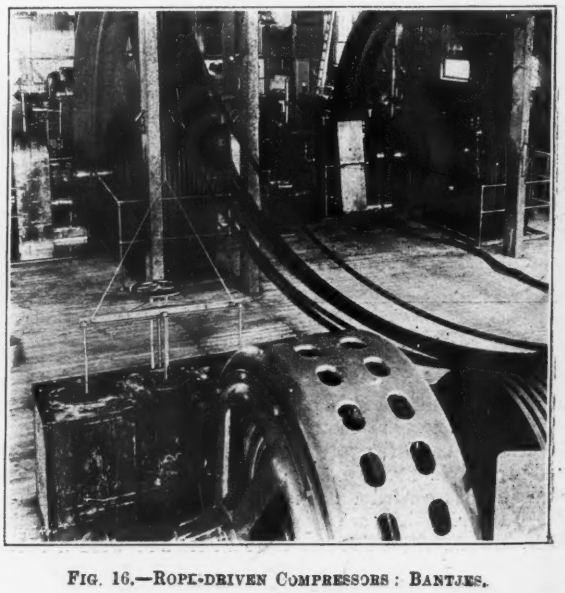


Fig. 16.—Rope-driven Compressors: Bantjes.

CONTRACTS CLOSED.

(*Continued from page* 584.)

Aberdeen.—Mr. Thomson has secured the contract for the electrical installation at the City Hospital extension.

Belfast.—The Corporation Tramways Department has placed a contract with Messrs. Siemens Bros. Dynamo Works, Ltd., for carbon filament lamps for twelve months.

Bristol.—The T.C. Docks Committee has accepted the tender of Messrs. W. T. Henley's Telegraph Works Co. for 47 coils of vulcanised I.R. cable, of various sizes.

Colchester.—The T.C. has accepted the following tenders for supplies to the electricity works :—

Stamford & Co., Bagshaw.—Coal elevator, £89.
Pope's Lamp Co.—Metallic-filament lamps.
Joslins, Ltd.—Prepayment installations.
Lucy & Co.—Fuse-boxes.
Paisley Engineering Co.—Castings.
Williams & Co.—Electrical accessories, oils, &c.

Edinburgh.—The Corporation E.L. Committee has settled the coal contract for the coming year at about 4s. 6d. a ton more than was paid last year. The coal bill for next year is increased by £10,000.

Halifax.—The Corporation Electricity Department has placed a contract for 10, 25, and 50-amp. D.P. ironclad switches, required during the next 12 months, with Messrs. J. H. Tucker and Co. The Tramways Department has placed a contract for lampholders, switches, &c., for the same period, with the same firm.

Hampton.—The U.D.C. has accepted the tender of Messrs. Stuart & Moore for fire alarms in Station Road, at £18 12s., with 30s. per annum for maintenance.

Ilford.—The following tenders have been accepted by the U.D.C. for annual supplies to the Tramways Department :—

Messrs. Wiseman.—Trolley heads and harps.
British Westinghouse Co.—Armature coils.
Le Carbone, Ltd.—Carbon brushes.
Scholey & Co., Ltd., and British Thomson-Houston Co.—Pinions and gear wheels.
John Brown & Co.—Tires, steel, and special steel.
B.I. & Helsby Cables, Ltd.—P. & S. substitute tape, and Para tape.
L. Andrews & Co.—Blackley tape.
F. Smith.—Piano wire.
Dussek Bros. & Co.—Graphite grease.
A. B. Gross & Co.—Motor grease.
Joslins, Ltd.—Oil.
R. Kearsley & Co.—Varnishes.

Lichfield.—The T.C. has accepted the tender of Messrs. Clive & Co. for alterations to the telephone service in connection with the electric fire alarms, and the provision of poles, relay bell, insulators, lines, &c.

London.—Bermondsey.—The undermentioned purchases of coal have been made by the Electricity Committee :—C. Tucker & Co., 10 tons wharf small, 22s. 3d. per ton ; Charrington, 16 tons nutty slack, 25s. ; W. Moore & Co., 10 tons wharf small, 21s. ; Thorpe, Head & Co., 20 tons wharf small, 20s. ; Myers, Rose & Co., 100 tons Stanley slack, 18s. 9d. ; Bradbury & Co., 30 tons nutty slack, 23s. 6d. ; Thorpe, Head & Co., 60 tons nutty slack, 20s. ; Dinham, Fawcus & Co., 100 tons West Hallam nuts, 25s. ; 100 tons, Sharlston pea slack, 25s. ; 100 tons West Hallam nuts, 25s. The Committee recommends the Council to continue, for a further period of two months, to pay Bradbury, Son & Co., Ltd., the increased charge of 1s. 6d. per ton on the coal contract.

Meter Contracts, &c.—The Swindon and West Hartlepool municipal authorities have accepted tenders of the Bastian Meter Co., Ltd., for the supply of Bastian meters, of from 3 to 10 amperes and 2½ to 5 amperes respectively.

The Electrical Apparatus Co., Ltd., has obtained a contract from the Dundalk U.D.C. for the supply of house service meters for the year ending March 31st, 1916.

Messrs. J. H. Tucker & Co. have recently received contracts for annual supplies of service fuse-boxes from Ilford U.D. Council, Bolton and Blackburn Corporations; for lampholders from Swindon Corporation ; and for ironclad switches from Dundalk U.D. Council.

Messrs. Chamberlain & Hookham, Ltd., have received contracts from the following towns for the supply of meters for 12 months :—Kirkcaldy, West Hartlepool, Swindon and Pontypridd.

The British Westinghouse Electric and Manufacturing Co., Ltd., have recently received contracts from the following supply authorities for single-phase A.C. house service watt-hour meters :—Bath Corporation ; Beckenham Urban District Council ; Blackburn Corporation ; Bristol Corporation ; Croydon Corporation ; Eccles Corporation ; Ipswich Corporation ; Leeds Corporation : Rhondda Urban District Council ; Watford Urban District Council ; West Ham Corporation.

Southampton.—The Borough Insurance Committee has accepted the tender of Messrs. H. C. Taplin & Sons for the E.L. installation at the Committee's offices.

Sunderland.—Correction.—In last week's issue, "C.O. two recorders" was, of course, a printer's error for "CO_2 recorder."

Thames Ditton.—The U.D.C. has accepted the tender of Messrs. Stuart & Moore for electric fire alarms at Claygate, at £82 2s.

Windsor.—The T.C. has accepted the tender of the Windsor Electrical Installation Co., Ltd., for the electric light installation at the waterworks and house with 54 lights, at £64, with £22 for an extra lighting main.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 23rd. At 8 p.m. At 39, Victoria Street, S.W. Paper on "The Developments of the Navy," by Mr. E. W. Hobbs.

Physical Society of London.—Friday, April 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Paper on "The Self-Induction of Solenoids of Appreciable Winding Depth," by Mr. S. Butterworth.

National Association of Colliery Managers and Association of Mining Electrical Engineers. Saturday, April 24th. At University College, Nottingham. Joint meeting. Paper on "Protective Devices against Lightning and Surges," by Messrs. E. Kilburn Scott and L. F. Fogarty.

Association of Mining Electrical Engineers (Lancashire, Cheshire, and North Staffordshire Branch) and North Staffs. Branch of the Colliery Managers' Association.—Saturday, April 24th. At 3.30 p.m. At Technical College, Stoke. Paper on "Colliery Electric Lighting," by Mr. G. S. Coriett.

Illuminating Engineering Society.—Tuesday, April 27th. At 8 p.m. At the House of the Royal Society of Arts, John Street, Adelphi. Discussion on "Visibility: its Practical Aspects," opened by Messrs. C. C. Paterson and B. P. Dudding.

Institution of Civil Engineers.—Tuesday, April 27th. At 8 p.m. At Great George Street, S.W. Annual General Meeting.

Association of Supervising Electricians.—Tuesday, April 27th. At 8 p.m. At St. Bride Institute, Bride Lane, E.C. Paper on "Lightning Conductors," by Mr. H. C. Hands.

Dynamicables.—Wednesday, April 28th. At Trocadero Restaurant. Anniversary Meeting and Dinner.

Royal Society of Arts.—Wednesday, April 28th. At 8 p.m. At John Street, Adelphi, W.C. Paper on "The Utilisation of Solar Energy," by Mr. A. S. E. Ackermann.

Institution of Electrical Engineers.—Thursday, April 29th. At Victoria Embankment, W.C. Paper on the "Bombay Hydro-Electric Scheme," by Mr. A. Dickinson.

(**Manchester Local Section**).—Tuesday, April 27th. At Engineers' Club, 17, Albert Square. At 7 p.m. Annual General Meeting. At 7.30 p.m. Mr. Dickinson's paper, as above.

(**Students' Section**).—The Annual General Meeting has been postponed from April 28th to May 5th.

Royal Institution of Great Britain.—Saturday, May 1st. At 3 p.m. At Albemarle Street, W. Lecture (I) on "Photo-Electricity," by Prof. J. A. Fleming, F.R.S. At 5 p.m. Annual Meeting.

NOTES.

Institution and Lecture Notes.—Iron and Steel Institute.—The annual meeting will be held at the Institution of Civil Engineers at Westminster, on May 13th and 14th. In the event of Mr. Greiner being unable to attend, Mr. Arthur Cooper, LL.D. (immediate past-president), will preside. The Bessemer Gold Medal for 1915, which has been awarded to Mr. Pierre Martin (formerly of Sireuil, near Paris), will be received on his behalf by his Excellency M. Paul Cambon, the French Ambassador, who has consented to attend. Prof. Hubert (Liége University) is to deliver an afternoon lecture on "Large Gas Engines." In the programme of expected papers there is one by Messrs. A. M. Portevin and E. L. Dupuy, on "Thermo-Electric Properties of Special Steels." On account of the war the annual dinner will not be held. It is provisionally settled that the autumn meeting will be held in London during the week ending September 25th.

Institution of Electrical Engineers.—The annual general meeting of the Students' Section has been postponed from April 28th to May 5th, at 7.45 p.m., when Sir John Snell will give an address.

Royal Society of Arts.—On Wednesday last week, Mr. T. Thorne Baker read a paper on "The Industrial Uses of Radium," dealing mainly with the application of the residues of radium factories to agricultural purposes. He stated that the α-rays produced increased vitality and quicker germination of seeds, and that radium emanation accelerated the growth of plants. Salts containing exceedingly small quantities of radium had been used for the treatment of rheumatism with highly satisfactory results, and radium could be used to clot milk in place of rennet. The use of radium to render watch hands luminous in the dark was also described.

The Government and War Munitions.—From a notice which appears in our advertising pages to-day, it will be seen that firms engaged on the manufacture of armament and munitions of war and requiring additional machinery, are requested to communicate with Mr. George M. Booth, Room 367, War Office, Whitehall, S.W., giving particulars.

Educational Note.—Crystal Palace School of Practical Engineering.—The new course will commence on Wednesday, April 28th. See our advertisement pages to-day.

Large D.C. Generator.—Four large direct-current generators are now being installed in the Detroit plant of the Ford Motor Co. by the Crocker-Wheeler Co., Ampere, N.J. Each of these machines will be directly connected to a two-cylinder tandem gas engine and a compound condensing steam engine.

The maximum diameter of the generator shaft is 34 in.; it is 26 ft. long, and weighs approximately 35 tons. The greatest diameter of the armature is 15 ft. 10 in., and its total weight is 42·5 tons. The armature spider is of cast-iron, and is cast in two parts, each part weighing about 9 tons. Eight bolts are used to hold the spider halves together, each bolt weighing 500 lb., and each fluted nut, of which there are 16, weighing 90 lb. In order to obtain the proper tension on the bolts, each bolt was heated before being placed in position, so that on cooling after the nuts had been tightened the bolt contracted and drew the two halves of the spider together with great force. The laminated core consists of 26,000 separate parts, each part having to be handled separately during the process of assembling. There are 10,000

Frame of Direct-Current Generator for Ford Plant.

core laminations and 5,600 core ventilators. The commutator is made up of 630 copper bars insulated from each other and assembled on a cast-iron spider frame. This spider frame is also made in two parts, each weighing 5,000 lb. The diameter of the commutator over the bars is 9 ft. 2 in., and its total weight is 10 tons, of which 4 tons is copper. The completed armature mounted on the shaft is supported on two bearings, each being 33 in. in diameter and 5 ft. long.

The magnet frame is of cast-iron and has a section resembling an enlarged T-rail section. Like the other large castings, it was cast in two parts, each weighing 20 tons. The outside diameter of the frame is 22 ft. 2 in., and the distance across the base 25 ft. 8 in. Thirty main poles and 30 interpoles were bolted to the inside of the frame after the field coils were in place. The rocker ring to which the brush-holders are fastened is supported by brackets cast on the side of the magnet frame. The rocker ring is of cast-iron, and has an outside diameter of 20 ft. It weighs 4 tons. The machine is equipped with 240 brushes.

The total weight of the generator, including the shaft, is about 135 tons, of which 13 tons is copper. At 250 volts the generator is rated at 15,000 amperes. The normal rating of the machine is 3,750 KW., and the maximum rating is 4,500 KW. The generator operates at a speed of 80 R.P.M., which gives a peripheral velocity of the armature of about a mile a minute. It was necessary to split the large castings in order to meet railroad-tunnel clearances.—*Electrical World.*

Electricity in the Roumanian Petroleum Industry.—Important modifications have recently been introduced in the rules governing the use of electricity in the Roumanian petroleum industry. A *résumé* of the revised regulations follows, and deserves the notice of manufacturers concerned, since Roumania is one of the fields in which advantage may be taken of German paralysis to extend our own trade. Squirrel cage motors are ill adapted, by reason of their high and invariable speed, to the requirements of the petroleum industry, hence the rule prescribing the use of these machines has been considerably broadened. Step-down transformer stations fed at 1,000 volts, or higher pressure, and all generating stations must be at least as far from any boring as the distances prescribed for boilers and forges in collieries. Where there are no spouting wells, transformers in gas-tight chambers are excepted from this rule. Transformers working at 1,000 volts or lower pressure, and supplying lighting current, are permissible near the well if they and their fuses and switchgear are oil-immersed. In the immediate neighbourhood of the well, one and the same cable must be used for lighting and power. Special switches and fuses for the lighting and motor branches must be located in the motor room and accessible only to authorised persons. Lighting generators or transformers at the well-head must be in fireproof buildings, accessible only to authorised persons. In no case is more than 1,000 volts P.D. permissible between conductors in a sinking. High-pressure circuit-breakers isolating sinkings may be mounted on the poles, if oil-immersed; other switches or fuses may not be so mounted. Lightning conductors with spark gaps are forbidden. An oil-immersed isolating switch must be provided in each well network, for use in case of fire. Single-pole switches are forbidden; multipole switches must be mechanically coupled. Telegraph, telephone and signalling apparatus must produce no open sparking, and must incorporate devices safeguarding possible contact of their wires with high-pressure leads. Only hermetically-sealed glow lamps with armoured protecting globes are permitted in the workings, and in the latter the use of direct-current motors is forbidden. Short-circuited induction motors of the squirrel-cage type should be used whenever possible in the workings. Slip-ring motors are permissible so long as all sparking parts are enclosed in a chamber which is sealed automatically and hermetically. An official certificate is required as to the safety of the motor in a gas-filled space and as to the maximum temperature rise of the controlling resistances. Switchgear or other apparatus capable of producing a spark in the motor room must be oil-immersed, unless the casing is hermetically sealed, and excepting lighting fuses up to 10 amperes capacity. Owners are bound to employ at least one qualified electrician certificated by the authorities; this electrician and the works manager are responsible for the proper erection and operation of the installation. Only equipment sanctioned by the Minister of Commerce and Industry may be installed, hence care should be taken that all necessary formalities are concluded before delivery is made or special expenditure incurred. Full particulars, plans and specifications of proposed equipment should be laid before the authorities, who will advise what alterations or substitutions are required in the event of the first proposals being unsatisfactory.—*Moniteur du Pétrole Rumain.*

Telephony and Telegraphy in the Field of War.—A graphic account of field telegraph and telephone work has been contributed to a Frankfort newspaper by a correspondent who, on the occasion of his presence with the army commanded by the Crown Prince of Bavaria, had an opportunity of inspecting the entire telegraph and telephone system of this particular army in the western area of operations. The exchange for the whole of the traffic was located in a large private house; it was equipped within three weeks, had 95 direct lines and established about 5,000 connections daily. In order to carry out the work, which comprised lines of a total length of 740 miles, 300 men of the First Bavarian Telegraph Battalion were available, and these were able to lay 54 lines in a single day immediately after the exchange was finished. The difficulty of executing the works was increased by the circumstance that French apparatus was employed for the greater part, and this had to be altered to correspond with German requirements and custom, the apparatus being found in French Post Offices. It was also possible to use the French network to some extent, although it was largely destroyed. Notwithstanding all the difficulties the exchange was soon completed, and a network of communication was provided which had direct lines right down to the divisions and rendered possible direct communication with the grand army headquarters and the neighbouring armies.

Each Army corps can be reached by means of five different lines, and from these the divisions can each be called by at least two different lines. Lines from the divisions then lead to the brigades and regiments, and the terminal line proceeds to the trenches, from which every battalion, and, in many cases, every company has a connection to the rear. To these means of communication are added the numerous lines necessary for the artillery, artillery observers in the trenches, &c.

Communication with neighbouring armies is effected by means of two direct lines in each case, whilst two similar lines maintain connection with the grand headquarters. In addition each army corps is connected by direct lines with its neighbouring corps, and each division with its adjoining division. It has frequently been necessary to carry out repairs necessitated by storms, and besides there has to be taken into consideration the much endangered situation of the telephone stations in places where they must be maintained for military reasons, and where they lie within the range of hostile artillery fire. Stations indeed exist which are continuously fired at, and security has to be sought in deep cellars which are made bomb-proof as far as possible. Many lines are shot down, and the places of interruption have to be discovered and the necessary repairs promptly made to maintain communication. The telegraph traffic is effected in this army as at the grand headquarters by the use of the French Hughes apparatus, and the daily work ranges from 900 to 1,000 service telegrams, thus almost, if not entirely, excluding any private messages.

A number of portable stations for wireless telegraphy are also associated with the army. These stations, which are partly hauled by horses and partly by motor cars, have a quiet period in times of fighting for positions, but a great strain is imposed upon them when movements are taking place. The range of the stations is a few hundred kilometres. The lines of the army chief command are connected to the rear with those of the service corps, which are worked by the telegraph service corps, and are then joined further to the rear with those of the general government, which are operated by the Imperial telegraph department.

A central depôt has also been provided for meeting the requirements in telephone and telegraph material of the cavalry, infantry, pioneers, and telegraph troops. The manager of the depôt always has in stock a quantity of the necessary materials. The reserve is

kept in trucks on rails, and each box is at once accessible and bears an indication of its contents. The deliveries from the depôt to the troops are effected partly direct by rail and partly by means of heavy motor lorries, which frequently have to be driven almost to the trenches, whilst special depôts are provided for furnishing telephone materials to the artillery.

Buffer Batteries for Alternating-Current Systems.—An illustrated account of experience with buffer batteries on alternating-current systems is given by L. Schroeder in the *E.T.Z.*, the fundamental idea being shown in fig. 1. G is the three-phase generator which supplies energy to the three-phase bus-bars B C, while N is the network; M D is a motor generator, M being the three-phase motor and D a direct-current generator. The latter acts in co-operation with the storage battery A. In the bus-bars a series transformer is provided, the secondary current of which is rectified by means of the synchronous converter R. The direct current which comes from the synchronous converter is approximately proportional to the current in the network, and is used to regulate the booster Z. For this purpose the direct-current from R is passed through the magnetising winding *a b* of the booster. This booster has also a second excitation winding *c d*, which is fed from the battery A. The two excitation windings *a b* and *c d* act in opposition, and are so dimensioned that at the average load in the network the actions of the two windings counterbalance each other, so that the booster is unexcited and the battery is

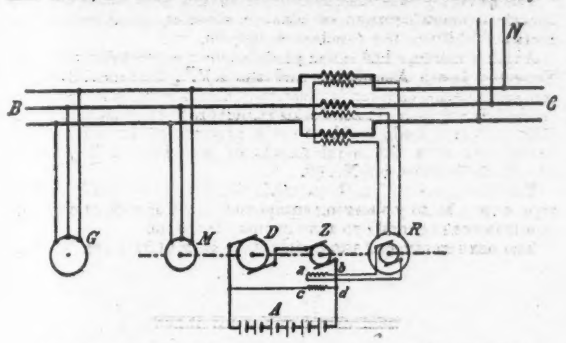


Fig. 1.—Wiring Arrangement for Buffer Battery.

neither charged nor discharged. If the load in the network increases, the action of the winding *a b* is greater than that of *c d*, and the booster is now excited in such a way that the storage battery is being discharged. The battery, therefore, drives the direct-current generator D, and the three-phase alternator M now becomes a generator and supplies energy to the network. On the other hand, if the load in the network decreases below the average value, the storage battery A is charged. For the regulating generator R use is not made of an ordinary synchronous converter, but of a Danielson converter, with the modification due to Woodbridge. This arrangement was used in tests in which the normal load of

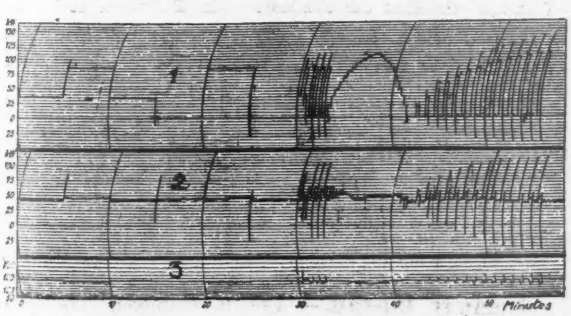


Fig. 2.—Results of Tests.

the network was 35 KW. The battery consisted of 106 cells, with a discharge current of 259 amperes for one hour. The results of the tests are given in fig. 2, in which Curve 1 represents the load of the network in kilowatts, Curve 2 represents the load of the dynamo in kilowatts, while Curve 3 represents the voltage in the network. The abscissæ represent minutes. It will be seen that even though the load in the network was increased to 108 KW.—that is, more than three times the normal load—the buffer battery arrangement acted quite satisfactorily. If the generator suddenly stops work and the battery is forced to supply the whole current, the voltage in the network drops, but can be brought up to its normal value quickly by a simple change of connections.—*Electrical World.*

Shortage of Switchboard Attendants.—Our contemporary, *Electrical Engineering*, has prepared a scheme for enrolling in Electrical Emergency Service as volunteer switchboard attendants for part time, electrical men who are ineligible for active service and are willing to assist in cases of emergency. Particulars may be obtained on application to our contemporary at 203, Temple Chambers, London, E.C.

Parliamentary.—Dewsbury Corporation Bill.—The Omnibus Bill of the Dewsbury Corporation, after being before Mr. W. Middlebrook's Select Committee of the House of Commons on various dates during the past month, was ordered on Friday to be reported to the House for third reading. Mr. Vesey Knox, who represented the Corporation, explained that an agreement had been arrived at with regard to the tramways portion of the Bill. The Corporation were asking for powers to construct additional tramways and for further powers over the existing tramway and electricity undertakings. The Corporation desired to link up the whole system in the borough and secure running powers over the whole of the lines either of themselves or of those with whom they might make them lessees or licensees when the present agreements came to an end in 1933.—Mr. Councillor J. E. Kilburn (chairman of the Tramways Committee) stated that the Corporation were satisfied with the agreement which had been made by the parties concerned.

Sheffield and Rotherham Tramways.—The Select Committee of the House of Lords, presided over by the Duke of Wellington, considered the Bills promoted by the Sheffield and Rotherham Corporations together. Mr. Vesey Knox, K.C., and Mr. Gee appeared for the Rotherham Corporation, and Mr. H. Lloyd, K.C., and Mr. Tyldesley Jones for the Sheffield Corporation. The Rotherham Bill dealt with various matters, and included powers for doubling a portion of the existing track, the laying of a single track in the direction of Maltby, and for making arrangement for through running between Sheffield and Rotherham. The Sheffield Bill contained powers for the construction of new tramways, and for the purchase of the tramway in that part of Tinsley now taken into the city, which belongs to the Rotherham Corporation. Mr. Vesey Knox explained that the only opposed part of the Bill of the Rotherham Corporation was with regard to what was to become of the Tinsley tramway. The Sheffield Corporation proposed in their Bill to purchase this tramway, which was the property of Rotherham until 1926. The two places were competing in tramways, and the Tinsley line was the link between the two larger systems. There had been through running up to September, but in consequence of differences of opinion about halfpenny fares, the through service had been suspended. The Sheffield Corporation threatened to run motor-omnibuses to compete on the route, and the Rotherham Corporation promoted the Bill to prevent this being done. This was followed by the Sheffield Corporation promoting their Bill to compulsorily acquire the Tinsley tramways. After several unsuccessful consultations between the parties to arrive at an agreement, the Committee passed Clause 14 of the Rotherham Bill, which provided for through running, with the addition that nothing in the Act should interfere with the running of motor-buses by the Sheffield Corporation until such time as the Board of Trade should be able to decide the question. The parties subsequently came to terms as to the wording of the clause, and also as to the principal clauses in the Sheffield Bill, which was referred to the Chairmen of Committees for final adjustment.

"Sole Agents."—"One of Several Sole Agents" writes as follows:—"Some time ago a very plausible person called on us, with what he described as telephone shields for attaching to telephone transmitters to prevent contagion. He laid great stress on the fact that they had been passed by H.M. Postmaster-General on a date stated, and also that if we purchased a small stock we were to have the sole agency, &c. It was a cash transaction, and goods were left, but we afterwards discovered at least three sole agents existed in one small town, and efforts to get in touch with his firm resulted in numerous addresses being reported 'Gone away, no address.' We strongly advise electrical clients and stores to think twice before taking up the 'Sole agency' until they have tried the goods. A 'Sale or return' arrangement would be much better."

A Business Club for London.—Owing to the lack in London of a Commercial Club of national or imperial scope, steps are being taken to meet the want, which is described as a great inconvenience to the manufacturers, merchants, shippers and business men of the British Isles, and is, above all, keenly felt by commercial visitors from our Colonies and foreign buyers visiting the metropolis for business purposes. The Council of the British Empire Industrial League have given serious consideration to this matter, and are making arrangements to found in London the British Empire Commercial Club on such a basis as will supply what cannot be otherwise regarded than as a metropolitan, national and imperial requirement. It is hoped that the Club will receive the hearty and generous support of our manufacturers, exporters and wholesale and retail merchants, and other leading men connected with business.

War Office Contracts and Workers' Badges.—In the House of Commons, on Tuesday, Mr. Baker stated that arrangements were complete for the issue of badges to workmen engaged on War Office contracts, but it had been decided to limit them to skilled workmen engaged in the manufacture of munitions of war. Mr. Terrell asked if "munitions of war" included electrical equipment in the field, and Mr. Baker replied that he thought the answer would be in the negative.

Fatality.—John Sterling, who was employed at the coal-cutting machine at Derryloanhead Pit, Derry, was found dead in the mine on Monday morning, having apparently been killed through coming in contact with an electric cable

Electrical Prosperity Week.—The Society for Electrical Development, U.S.A., has, as already stated, decided to hold an "Electrical Prosperity Week" during the first week in December next, and has appointed a strong Committee to conduct the preparatory campaign, Mr. H. W. Alexander having charge of the publicity work, and Mr. J. M. Wakeman being the general manager. Local agents have been appointed to handle the campaign in 50 centres, and every known device will be employed to ensure its success. It is stated that "this big movement will unquestionably be the greatest educational and sales campaign ever carried on in the history of the industry."

The scale upon which the Society is preparing for its great campaign is evidenced by the fact that £10,000 has been allocated to special expenditure for advertising purposes, in addition to a still larger outlay on other items. The money will be provided out of the regular subscriptions of the Society's members. Leading electrical manufacturers and dealers have also declared their intention of spending large sums on national publicity. The week will date from November 29th to December 4th, 1915. Advisory Committees have been appointed on general publicity, advertising, exhibitions and lectures, and on local displays, and local Committees will also be formed. It is anticipated that fully £100,000 will be spent on this, "the greatest campaign in trade history," before its close.

Copper.—Mid-monthly returns, as tabulated in Messrs. H. R. Merton's statistical circular, show an increase in European visible supplies of 315 tons. English supplies, since March 31st, show a decrease of 210 tons. From the figures relating to detailed supplies, it appears that European arrivals from North America appear to be slightly lower than for last month, though very considerably higher than the quantity for November, 1914, or February, 1915, in fact they promise to exceed the supplies for any month of the last eight, except March. Supplies from Spain and Portugal to England and France for the fortnight are at a rate of double the pre-war average, but it is probable that this rate will not be kept up, shipments from these countries always varying considerably from month to month. Chile shipments are considerably above pre-war average; Australian, however, are below. Total deliveries are not at such a high rate as last month but at a higher rate than any other month since July.

Appointment Vacant.—Switchboard attendant (30s.) for Plymouth electricity works. Particulars are given in our advertisement pages.

The Coal Supply.—Last month a deputation representing the industries which are large consumers of coal waited upon the Board of Trade, and drew attention to the abnormally high price of coal, with a view to obtaining the intervention of the Government, and, if possible, the fixing of fair prices. Up to the present but little benefit has been derived from this action, though a Committee appointed by the Board of Trade has published a report which bears out the statements made by the deputation. At a meeting of the Manchester District Institution of Gas Engineers on Tuesday last week, reported in the *Journal of Gas Lighting*, the question was discussed, and it was agreed that influence ought to be brought to bear upon members of Parliament with a view to urging the Government to take immediate action in the direction of restricting the export of coal, facilitating transport by rail, and preventing unnecessary increases in the price of coal for next year's requirements.

The meeting also recommended that a conference of gas and electrical undertakings throughout the country should be called as soon as possible.

Commenting on this subject, our contemporary laments the inaction of the Board of Trade, and regards the outlook as very serious, particularly in view of the apparent inability of the authorities to appreciate the importance of the question. The demand of the miners for a 20 per cent. war bonus increases the gravity of the situation, and the *Journal* rightly condemns the self-seeking tendency which is so manifest, at a time when every man should put his shoulder to the wheel. The attitude of the coal-owners is especially reprobated, as it is stated that they are endeavouring to make exorbitant profits, beyond all reason.

The *Journal* supports the proposal that the gas and electricity industries should join forces, and suggests that the central organisations of the two industries should take immediate action towards this end.

We cordially welcome the suggestion, and trust that it may be quickly carried into effect. Recent articles in our columns have indicated the difficulties that are being met with by electricity works, and unless strong action is taken there is every likelihood that these difficulties will become more acute, very much to the detriment of the industry.

It rests with the Council of the Institution of Electrical Engineers to take the first step towards holding a National Conference, and station managers who desire relief from the present burden, and safeguards against additional burdens, ought to lose no time in pressing their views upon that body by letter and by personal representations to its members.

Electric Vehicle Committee.—The question of increasing the sales of the *Journal* was considered at the meeting held on April 15th, the Committee feeling that electricity supply undertakings might do much more in the way of utilising the *Journal* for distribution among prospective users in their districts.

It was reported that many undertakings were restricting their expenditure on publicity material during the war, owing to the regulation of the Government prohibiting further capital expenditure on ordinary mains extensions, and also limiting expenditure generally. It was resolved to point out to the undertakings that the adoption of electric vehicles did not necessarily entail any extension of the mains or plant. The supply was entirely an "off-peak" load, and undertakings on that account should, at the present time, use every endeavour to make known the advantages of electric vehicles. Undertakings are to be asked to make use of the publicity mail cards prepared by the Committee, the demand for which has been very small indeed, and confined to a very few undertakings up to the present.

Those undertakings in the Metropolitan area that charge more than 1d. per unit for electric supply to vehicles have been asked to come into line with the Committee's recommended tariff of 1d. per unit, but no satisfactory reply has been received from any undertaking to which the letter has been addressed.

It was reported that certain undertakings had found it necessary to advance prices all round owing to the increased cost of coal, &c. It was decided that where such advance in price was only of a temporary nature, the undertaking concerned should still have its name in the list in which it at present stands on the tariff sheet of the *Journal*.

As there are vehicles not fitted with the standard receptacle which come to certain stations for charging, the Committee decided to insert a paragraph in the next issue of the *Journal*, advising electric supply undertakings to do what they can to persuade the owners of such cars to have the standard receptacle fitted.

The secretary was also instructed to get into touch with the American manufacturers of electric vehicles, pointing out the necessity of fitting the standard receptacle.

Another meeting had taken place between representatives of the Tungsten Lamp Association and the E.V.C. Technical Sub-Committee regarding the standardisation of metal-filament lamps for use on electric vehicles. It was decided to adhere to the recommendation that the lamps used should be for a pressure of 12 volts, and in accordance with the requirements of the British Engineering Standards Specification No. 69.

Further progress has been made with the preparation of the report upon battery charging equipments and methods of charging, and it is hoped shortly to have it ready for issue.

The next meeting of the Committee has been fixed for May 11th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—An interesting presentation took place at Blackpool electricity works on April 15th, when a token of friendship in the shape of a kit bag was given to MR. E. HARDMAN, who is leaving the staff to take up a position with a Yorkshire electrical car company. Mr. Parkinson made the presentation.

MR. J. H. SPARROW, Southsea, has been appointed switchboard attendant at the Bermondsey electricity works. There were six applications for the post.

MR. FRANCIS D. LARCOMBE has resigned his position as control engineer for the Yorkshire Electric Power Co. after ten years' service to take up a position on the commercial organisation of the British Westinghouse Co., Manchester.

MR. FOWLES, of Erith, has been appointed chief assistant electrical engineer to Aylesbury U.D.C. There were 42 applicants.

MR. H. M. THEAKER, shift engineer of Manors Power Station, Newcastle-on-Tyne Corporation Tramways, was married to Miss Maud Robinson, of Mossley, nr. Manchester, at Scouthead, Oldham, on April 14th.

Tramway Officials.—The Southampton Tramways Committee has unanimously resolved to appoint MR. W. T. ROBSON, A.M.I.E.E., of South Shields, as tramways manager, at a salary of £400 per annum.

MR. J. J. MCMAHON, electrical engineer in the overhead department of the Manchester Corporation tramways, who, as reported in our columns recently, was a passenger on the *Aguila*, which was torpedoed by a German submarine, reached Manchester safely last week, and was welcomed back by a small party of Councillors and tramway officials. Mr. McMahon was picked up by the ss. *Lady Plymouth*, bound for Madeira, and, when the vessel reached that port, he felt so shaken by his experience, that he decided to return at once.

General.—MR. G. JACKSON, of the technical staff of the British Insulated and Helsby Cables, Ltd., Helsby, has been presented by his colleagues with a handsome set of carvers upon the occasion of his marriage. The presentation was made by Mr. A. E. Bayles, chief of the technical staff.

MR. JOHN F. SKINNER, Mitchelstown, has been appointed electrician at the Clonmel Lunatic Asylum.

MR. M. BARRINGTON BAKER, A.M.I.E.E., has completed his contract for the Crown Agents in Zanzibar, and is now proceeding to Hong Kong as chief assistant engineer to the China Light and Power Co., Ltd.

Obituary.—E. J. Ljungberg.—We regret to read in the *Ironmonger* of the death which occurred on April 5th, in Stockholm, of Mr. E J. Ljungberg, managing director of Stora Kopparberg Co., of Falun, aged 73. The company with which the deceased was connected was one of the oldest and largest trading Corporations in Scandinavia. "Mr. Ljungberg thoroughly mastered the working of the various departments, both from the technical and the commercial point of view, and was responsible for many schemes and improvements for increasing the productive capacity of the company's extensive properties. He it was who first installed the plant for the manufacture of pig-iron by electricity. He was one of the ablest men his country has ever produced, and has justly been described as the 'grand old man' of Swedish industry and trade."

Mr. J. A. MacLellan.—The death occurred on April 14th, at Newton Abbot, of Mr. John Alexander MacLellan (of Messrs. Alley & MacLellan, Ltd., of Glasgow), at the age of 61 years.

The *Times* reports the death, at the age of 83 years, of Mr. H. M. Matthews, M.I.C.E., who was selected to examine and report on the lighthouses of the coast in 1878.

The death has taken place, at the age of 62 years, of Mr. Wm. Franklin, who had for many years been connected with the electrical department of Messrs. W. T. Henley's Co., Ltd., at Woolwich.

By a printer's error in our last issue, we stated that the late Mr. David Smith became secretary of the United River Plate Telephone Co. in November, 1914. This should, of course, have read 1904.

NEW COMPANIES REGISTERED.

Crombie's Patents, Ltd. (139,979).—This company was registered on April 16th, with a capital of £4,000 in £1 shares (2,000 10 per cent. non-cum. participating preferred), to acquire and turn to account a certain invention relating to improvements in apparatus and processes for the purification of liquids and the recovery of solids contained therein, to carry on the business of electricians, electrical engineers, suppliers of electric apparatus, etc., and to adopt an agreement with L. H. Raw. The subscribers (with one preference share each) are: W. C. Smith, "Montague," Durley Road, Bournemouth West, gentleman; L. H. Raw, Blomfield House, London Wall, E.C., engineer. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitors: Francis & Johnson, 19, Great Winchester Street, E.C.

H. L. V. Pearn and Co., Ltd. (139,951).—This company was registered on April 14th, with a capital of £1,000 in £1 shares, to acquire from A. E. Lamkin, of 86, Springfield Road, Brighton, electrical engineer, the benefit of certain inventions, to develop and turn to account the same, to carry on the business of electricians, mechanical engineers, suppliers of electricity, etc., and to adopt an agreement with the said A. E. Lamkin, F. H. Hadow, and H. L. V. Pearn. The subscribers (with one share each) are: A. E. Lamkin, 86, Springfield Road, Brighton, electrical engineer; H. L. V. Pearn, 134, Queen's Park Road, Brighton, gentleman; F. H. Hadow, 15, Harrington Gardens, S.W., gentleman. Private company. The number of directors is not to be less than two or more than five; the first are A. E. Lamkin, H. L. V. Pearn, and F. H. Hadow (chairman). Qualification, £100. Secretary, G. O. Gilland. Registered office: 3-7, Southampton Street, Strand, W.C.

Pearson's Electric Miners' Lamp Co., Ltd. (139,974).—This company was registered on April 15th, with a capital of £5,250 in 5,000 participating pref. shares of £1,000 each and 5,000 "B" shares of 1s. each, to carry on the business of manufacturers of and dealers in electric miners' safety lamps, accumulators, batteries, switchboards, charging boards and stands, electric light bulbs and fittings, lamps, radiators, condensers, and all other electrical appliances, etc. The subscribers (with one participating pref. share each) are: G. J. B. Porter, 2, Wardrobe Place, Doctors' Commons, E.C., solicitor; H. A. P——(?), 7, St. Kilda's Road, Stoke Newington, N., secretary; W. H. J. Welch, Namona, 349, Wanstead Park Road, Ilford, factory manager; J. Baker, 77, Lyndhurst Avenue, Streatham Hill, S.W., clerk; W. J. White, 2, Melrose Avenue, Mitcham, traveller; E. Mills, 48, Arodene Road, Brixton Hill, clerk; F. W. Godwin, 34, Madeira Road, Streatham, S.W., clerk. The first directors (to number not less than two or more than seven) are G. J. B. Porter, E. F. Hilton, B. R. Beale, G. Pearson, and L. R. Pearson. Qualification, 100 shares. Solicitors: Farrar, Porter and Co., 2, Wardrobe Place, Doctors' Commons, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Reduction Co., Ltd.—Particulars of £25,000 debentures, created February 9th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Midget Lamp Co., Ltd.—Particulars of £800 debentures, created April 8th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged, the company's property, present and future, including uncalled capital. No trustees A memorandum of satisfaction in full on April 8th, 1915, of debenture dated December 30th, 1911, securing £100, has also been notified.

CITY NOTES.

Evered & Co., Ltd.

The directors report, after providing for debenture interest £1,390, and income tax £555, a net profit of £7,639, plus £2,116 brought forward. They recommend a dividend of 4 per cent. free of income tax (£6,830), writing off plant £1,000, and carrying forward £1,925. The death is recorded of Mr. J. D. Davenport, who had been a director since 1886. The directors regard the result of the year's trading as on the whole not unsatisfactory, bearing in mind the exceptional conditions that obtained after the outbreak of war. Up to the end of July, the course of business had been much upon the lines anticipated in the last report; and while uncertainty as to the duration and effect of the war renders it impossible to form any trustworthy estimate for the present year, shareholders will be interested to know that the company has in hand large contracts for war material, that will be a set-off against the direct and indirect losses to be expected in the company's normal trade. The company's debentures fell due for payment on April 1st, 1915, and, although not affecting the figures for the year under review, it may not be out of place to mention here that the sum of £20,600 has been renewed for five years by agreement, and the balance, £9,350, paid off. The directors have elected Mr. Edward T. Read to a seat on the board. Plant and premises have been maintained in good and efficient condition, and stocks taken at or below cost.

Annual meeting: April 28th.

Johnson & Phillips, Ltd.

The profit on trading accounts, etc., for 1914, after providing for bad and doubtful debts, and after charging to revenue more than £7,000 for maintenance of buildings, plant, etc., is £37,119, plus £12,755 brought forward. There fall to be deducted: Directors' and other remuneration, £1,862; interest on debenture stock, £6,085; debenture sinking fund reserve, £6,823; interest on second debentures, £2,500; depreciation on machinery and plant, etc., £8,158; interest on loan, £150. A dividend of 5 per cent. on the ordinary shares will absorb £8,750, leaving £15,546 to be carried forward.

Annual meeting: April 29th.

Babcock & Wilcox, Ltd.

The directors report that the net profit during the year amounts to £402,947, plus £73,835 brought forward, making £476,782. After deducting the interim dividends of 3 per cent. on the preference shares, 2½ per cent. on the second preference shares, and of 5 per cent. on the ordinary shares, amounting to £90,431, there is a balance of £386,351, from which the directors recommend that the following dividends be paid for the half-year ending December 31st, 1914, viz.:—3 per cent. on the preference shares £3,000, 2½ per cent. on the second preference shares (from both of which income tax is to be deducted) £4,459, 9 per cent. on the ordinary shares (free of income tax) £149,400, placing to the reserve fund £150,000, granting to the staff pension fund £10,000, and leaving a balance to be carried forward of £69,492. The business followed its usual course in 1914 until the war broke out. After this, the volume of new orders for stationary boilers decreased. The company has been able to manufacture some war material, required by the Government, at its Renfrew works, and having suitable buildings available at its tube works at Dumbarton, has equipped these with tools and appliances for machining shells, which are forged at the Renfrew works. Regular operation of this equipment has now commenced. The works at Renfrew have been well maintained, and plant and machinery have been added there to provide increased output of Government orders. The activity of the works and administrative organisations is unremittingly and preferentially devoted to Government requirements. About 800 of the staff and workmen have joined the Forces, and the board contributed to the maintenance of their dependents, and to the various war charities, upwards of £7,000 to the end of 1914. In common with other engineering firms, the company's output has been interrupted by strikes and other labour restrictions, and it has been hampered likewise by the scarcity of skilled men owing to so many joining the Forces. Apart from affecting the cost of Government work, these labour troubles affect the cost of the company's other contracts, particularly those entered into some time before the outbreak of war, which are now in course of being carried through.

Annual meeting: April 28th.

Anglo-Portuguese Telephone Co., Ltd.

The directors' report for the year ended December 31st, 1914, states that the assets and liabilities in Portugal have been made up at the exchange ruling on that date. Provision has, as usual, been made to safeguard the company from any serious consequences arising from fluctuations in exchange during the current year. The profit and loss account shows a gross revenue of £71,339, of which operating, management and general expenses absorbed £42,651, and royalties to the Portuguese Government £2,024, leaving a gross profit of £26,664. After providing for debenture interest £2,046 and sinking fund £1,554, the amount available for disposal, including £6,870 brought forward, is £29,934. Of this it is proposed to place £2,500 to exchange fluctuation account and to apply £10,000 to the formation of a renewals fund. In October last the directors paid an interim dividend of 3 per cent. less income tax amounting to £4,462. They now recommend the shareholders to declare a further dividend of 5 per cent., less tax, making a total distribution of 8 per cent. for the year 1914. This will absorb £7,500 and leave a balance of £5,472 to be carried for-

ward. The directors have decided to appropriate £60,000 of the reserve fund to the reduction of the capital expenditure account. Further depreciation is adequately covered by the unappropriated reserve fund and the renewals fund. The managing director, Mr. F. W. Kerr, visited Lisbon in January for the purpose of inaugurating the company's new North Exchange, the successful opening of which was attended by representatives of the Government and local authorities and the British Minister. Mr. Gill, the company's consulting engineer, on a recent visit to Lisbon, reported that he was pleased with the condition of the North, Central, and Trunk Exchanges at Lisbon.

Annual meeting: April 23rd.

Oriental Telephone & Electric Co., Ltd.

The directors report that for the year ended December 31st last, including £43,221 brought forward, and after deducting the interim dividends paid on the preference and ordinary shares, and making the necessary provision for redemption of the debenture stock and other charges as shown in the net revenue account, the amount to be dealt with is £78,128. The directors recommend a final dividend of 3 per cent. (less income tax) for the year on the preference shares, absorbing £1,500, a final dividend of 6 per cent. (free of income tax) on the ordinary shares issued, making 10 per cent. for the year, requiring £10,759, transferring to reserve account £5,000, to staff pension fund £2,009, and carrying forward £58,869. The revenues and the number of new subscribers at the various exchanges belonging to this company have increased during the year in every instance, as is the case with the subsidiary companies. The Bombay Telephone Co., Ltd., has further increased its dividend to 16 per cent., whilst the Telephone Company of Egypt, Ltd., the Bengal Telephone Co., Ltd., and the China and Japan Telephone and Electric Co., Ltd., have paid the same dividend as last year, viz., 10 per cent., 7 per cent., and 5 per cent. respectively. To meet the cost of further large extensions and improvements, the Bengal Telephone Co. during the year has increased its capital by an additional Rs. 1,000,000 in Rs. 100 shares, of which one half were issued. This company subscribed and paid for 2,209 of these shares at par, thus raising its holding in the Bengal Co. to 7,750 shares. The new exchange premises of the company at Port Louis, Mauritius, were opened in May last. New subscribers continue to join, and a small sub-exchange has been opened at Moka. It will shortly become necessary to lay an underground cable from Port Louis to Curepipe in order to provide a thoroughly efficient trunk telephone service between these two places and other up-country exchanges.

Annual meeting: April 28th.

Potteries Electric Traction Co., Ltd.

The capital expenditure during 1914 amounted to £12,072. The revenue amounted to £129,855. The traffic receipts, which amounted to £115,083, show an increase of £5,158. After deducting all expenses chargeable to revenue, including £11,303 for debenture and other interest, there remains £35,825, as compared with £38,529 for 1913. Adding £749 brought forward, there is a balance available for distribution of £36,574. There is to be placed to reserve account £6,500, and to renewals account £10,000. A dividend at the rate of 5 per cent. per annum on the preference shares absorbs £12,250, a dividend at the rate of 2½ per cent. per annum on the ordinary shares will absorb £6,125, and there is to be carried forward £1,699. The reserve account will then stand at £29,500, and there will be a credit balance on the renewals account of £26,520.

Negotiations were commenced during the year and are proceeding with the Stoke-on-Trent Corporation, with the object of securing the postponement by the Corporation of their right to purchase certain portions of the company's undertaking in the years 1917 and 1918. The omnibus service commenced in 1914 was extended during the year to other outlying towns and villages. The receipts from the omnibuses are included under the heading of 'traffic receipts in the revenue account. Since the close of the period covered by this report the War Office have impressed six of the company's omnibuses, and owing to the difficulty in replacing them at the present time the services have had to be curtailed. On the outbreak of war Mr. G. F. M. Cornwallis West, the late chairman, was recalled to the Colours, and has since retired from the Board. Mr. R. J. Howley, one of the managers of the B.E.T. Co., Ltd., was elected a director and appointed chairman. Messrs. Stephen Mear and F. W. Chanter are the directors retiring by rotation, and offer themselves for re-election.

	1913.	1914.
Miles open—Route miles	31.68	31.73
Single line	21.88	21.33
Double line	9.80	10.40
Passengers carried	21,610,714	21,842,310
Average receipts per passenger	1.22d.	1.26d.
Average working expenditure per passenger	.70d.	.77d.
Proportion of expenses to receipts	57 p.c.	61 p.c.
Cars in stock	110	110

Clevedon, Portishead and District Electric Supply Co., Ltd.

The annual meeting was held on the 14th inst., Mr. Thomas Richards presiding. The Chairman said that they were looking forward to an increase of business in the ensuing year. The directors had recently made a contract with the Bristol Corporation for the supply of electricity in bulk, and an arrangement had already been made with the South Liberty Colliery Co., at Long Ashton, to supply them with electrical power upon mutually advantageous terms. The residents of Long Ashton being desirous of having an electric lighting supply for their village, the company hoped to arrange for this extension, as the colliery was in the immediate vicinity. It was also proposed to extend the mains for the delivery of current from this source to Portishead, with the hope of being able to arrange with the Docks Committee for the supply of electricity for power and lighting at the Portishead Docks, negotiations for which were in progress. In any case, it was desirable that the cable should be extended to Portishead from Long Ashton, because this would afford facilities for the supply of electric light to the residential suburb of Leigh Woods, and the villages of Abbot's Leigh, Pill, and Portbury, adjacent to which the cable would be laid. These contemplated extensions would require additional capital, and after consideration the directors thought that rather than issue debentures at present, as intimated in the report, it would be better to offer preference shares of £1 each, bearing interest at 6 per cent. per annum. Financial arrangements had already been made to the extent of £9,000, and it was hoped shareholders and their friends would subscribe the remaining £3,000 to make up the total of £12,000, the approximate cost of the proposed extension, the sanction of the Treasury having been received for the issue of additional capital to this extent.

Mr. Napier said in comparing the revenue of the present quarter with that of the corresponding quarter of last year, it would be seen that there was a 20 per cent. increase.

Mr. Frank Christy reviewed the progress of the company, and referred to the negotiations for the contemplated extension. With regard to the South Liberty Colliery, he felt they had made an agreement which was equitable to both sides, and they were daily expecting the confirmation of the necessary Order from the Board of Trade for the work to be begun. It was anticipated that if no delays occurred this service would be installed early in the autumn.

Windsor Electrical Installation Co., Ltd.

Sir W. Shipley presided recently at the annual meeting. After referring to the death of Mr. Riley, who had been a director for nearly twenty years, he said that the war had, of course, adversely affected the financial position of the company, both in regard to receipts and working expenses. In Windsor they had suffered more severely than many towns owing to the Government lighting restrictions and the earlier closing of licensed houses, and by the Court not taking up its residence there as usual. Up to the war they had about 3,000 additional 8-c.p. lamps either connected or waiting—which was a record for recent years—and the total connections for the remainder of the year were about 900 lamps. Their revenue did not show an appreciable decline; while there had been a large increase in cheap power units sold, the revenue from the more profitable units had considerably declined. Receipts from the sale of current showed a good increase for the first half-year, but that was more than wiped out by decreases in the latter half, notwithstanding the benefit derived from the occupation of houses by the military authorities. The higher working costs were largely due to increased cost of fuel. Wages were higher, as nearly the whole of the station staff had joined some branch of the military service, and their places had been filled by others at wages ruling considerably higher than at the outbreak of war. They might have to consider the advisability of slightly increasing the price of current. In recommending a reduced dividend they had done what many companies had been compelled to do, but taking all the facts into consideration the result might be regarded as satisfactory. Their financial position was quite sound, and the increased business that they were now getting would show in the accounts directly the Government lighting restriction was removed, so that they had cause to be hopeful that the improvement in the results would be resumed.

Mr. H. L. Prior seconded, and the report was adopted.

Musselburgh and District Electric Light and Traction Co., Ltd.

The profit for the year 1914 was £7,547, and after deducting therefrom debenture interest, amount set aside for redemption of debentures, allowance to dependents of employés on active service, and depreciation on furniture, fittings, plant and tools, there remains a balance of £2,447, plus £257 brought forward. There is to be put to reserve and renewals account—tramways £2,000, and lighting £500, leaving £204 to carry forward.

Tramway Undertaking.—There is an increase of £673 in the profit as compared with 1913, but the traffic receipts since the declaration of war were seriously affected, particularly during the holiday season. The motor omnibuses purchased in 1905, the value of which stood at £2,003, have been scrapped, and the cost charged to tramways reserve and renewals account,

but the amount which the directors recommend should be transferred to this account practically counterbalances the amount taken out.

	1913.	1914.
Total revenue	£16,356	£16,604
Traffic revenue	£16,116	£16,381
Passengers carried	2,440,770	2,507,681
Car miles run	411,302	400,322
Average receipts per car mile	9.40d.	9.82d.
Average receipts per passenger	1.58d.	1.57d.
Cost of energy per car mile	1.99d.	2.01d.
Percentage of operating costs to traffic revenue ...	67.03	63.34
Percentage of operating costs to total revenue ...	66.04	62.50

Lighting Undertaking.—There is a decrease of £180 in the profit as compared with 1913. The receipts showed an increase of £235, but there was an increase in the expenditure of £425, principally under the heading of repairs and maintenance. The directors, however, are satisfied that this expenditure has been justified by the state of the plant generally at the present time, and they are advised that there should be a decrease under this heading during the current year. During 1914, Dr. Loewenfeld resigned his seat on the board, and the vacancy was filled by the appointment of Mr. R. Watson, who for some time past has been the commercial manager of the company at Musselburgh, and formerly secretary of the company.

The annual meeting was held on April 15th at 3, Laurence Pountney Hill, E.C., Mr. L. B. Schlesinger in the chair. The Chairman said that the tramway portion of the undertaking continued to show progress, but had it not been for the war that progress would have been much more marked. The traffic receipts from January 1st to the beginning of August showed an increase of nearly £700 over those for the corresponding period of 1913, but from the date war was declared there was a decrease in the receipts, and at the end of the year the actual increase had fallen to £250. Owing to the war the daily average receipts showed a decrease. Had times been normal there was every reason to believe that the increase of £700 at the beginning of August would have been increased to certainly over £1,000 by the close of the year. The receipts this year up to date showed a decrease of £700 compared with the corresponding period of 1914. That decrease was due not only to the effects of the war, but also to a strike of the company's employés, which, he was glad to say, was now ended. With regard to the electric lighting undertaking, it was satisfactory to note the increased revenue. Part of that increase was due to a temporary supply to some stores in Musselburgh owing to the breakdown of their plant. The supply was, however, still being given, and was likely to be taken for some weeks yet. There had also been a satisfactory increase in consumers for both lighting and power. Notwithstanding the increased revenue there was a decrease in the net profit of £180, due principally to expenditure on repairs and maintenance subsequent to the appointment of the new engineer. The board were advised that there should be a decrease under this heading during the current year unless something unforeseen happened. If the lighting undertaking did as well during the current year he thought they would have reason to be satisfied, owing to the increased price which they were now having to pay for coal, oil, and materials of every description. They had a contract with the Musselburgh Town Council for street lighting, but the lighting had been considerably reduced in accordance with instructions received from the military authorities, and the question of a rebate to be allowed to the Council in regard to the reduced consumption was now being discussed. Proceeding to deal with the accounts, the Chairman pointed out that in the balance sheet the cost of the omnibuses which were purchased in 1905 had been written off the reserve and renewals account. Those 'buses, he said, when originally purchased were not of the high standard of efficiency reached to-day. They were absolutely out of date and practically worthless, and it was better to get them out of the accounts. They were, however, recommending the addition of £2,000 to the reserve and renewals account to replace that item. The lighting reserve and renewals account had been charged with the cost of installing a new traction battery, which was giving satisfactory results and which would mean a considerable saving to the company. The debenture capital outstanding was now £87,500 against £88,200, £700 having been redeemed during the year. The directors had made allowances to dependents of the company's employés on active service.

Mr. W. B. Cownie seconded the motion, and the report was adopted.

Richardsons, Westgarth & Co., Ltd.—The report for 1914 states that the accounts, after providing £19,045 for maintaining buildings and fixed and loose plant, show a profit of £66,170. The results are very satisfactory, considering the difficulties encountered, and the fact that no assistance has been obtained from Government work during the period. The contracts booked before the war for delivery in 1915 are on the moderate basis of profit then prevailing, and most of them have had to be suspended owing to the cessation of mercantile work in the shipyards. This will result in accumulated interest charges, while the contracts during ultimate completion will have to bear increased working charges, as well as the war bonus of 4s. per week on wages, thus rendering the present position one of considerable uncertainty.

Direct United States Cable Co., Ltd.—The directors' report for the year ended March 31st, 1915, states that the reserve fund account shows a balance of £476,986, as compared with £451,491, an increase of £25,495. This is due to the cost of cable repairs having been exceptionally small during the past year, and while the directors are pleased to report that the cables are now in good working order, they believe, in view of past experience, it is in the best interests of the company to continue the policy of building up the reserve fund to such a figure as will provide for any contingency. Three quarterly interim dividends of 2s. each per share (less income-tax), amounting to £33,643, have been declared and paid during the year, and a final dividend of 2s. per share (less tax) is now proposed, making a total distribution of 4 per cent. for the year.

Annual meeting: April 27th.

Calcutta Tramways Co., Ltd.—The report for 1914 states that the revenue, including interest on investments and deposits, amounts to £109,035, plus £8,405 brought forward. A final dividend of 6s. 6d. per share, making 9½ per cent. for the year, is recommended, transferring to reserve for depreciation, &c., £15,000; to staff provident fund, £1,258; and carrying forward £7,566. In view of the exceptional taxation rendered necessary by the war, income-tax will in future be deducted from all dividends paid.

Potteries Electric Traction Co., Ltd.—For 1914 the revenue amounted to £129,855. The traffic receipts at £115,082 show an increase of £5,157. After deducting all expenses chargeable to revenue, including £11,303 for debenture and other interest, there remains £36,824, as compared with £38,528. The directors recommend placing to reserve account £6,500, to renewals account £10,000, a dividend at the rate of 2½ per cent. per annum on the ordinary shares, carrying forward £1,699.

Anglo-American Telegraph Co., Ltd.—Interim dividends for the quarter ended March 31st, 1915, 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax at 2s. 1d. in the £, payable on May 1st.

Montreal Light, Heat and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent., being at the rate of 10 per cent. per annum, for the quarter ending April 30th.

Kaministiquia Power Co., Ltd.—The directors have declared a dividend of 1½ per cent., or at the rate of 6 per cent. per annum, on the Common stock, for the quarter ending April 30th.

STOCKS AND SHARES.

Tuesday Evening.

Taken as a whole, the main feature of Stock Exchange markets during the past week has been one of steady improvement and better prices. To this it cannot be said that the news from the various fronts has contributed in any great measure. Mystery overhangs the various operations, and the man in the street chafes against the absence of information as much as he is annoyed, rather than perturbed, by the various rumours afloat.

Important relief to the financial situation has been afforded by further sensational rises in American Railroad shares. At first blush, there may seem to be no connection between these and such securities as electrical supply shares, for instance. Briefly put, however, the position is that the rises in Americans have led to large sales of the shares by English holders, who have received the money and want to invest it in domestic issues. At the same time, the exchange between the two countries is assisted by the share-purchases of the United States, which help to offset the supplies ordered in this country from Brother Jonathan in connection with the war. This latter consideration, affecting, as it does, the rate of exchange, is of value to all those who have commercial transactions with the States. The recovery in the price of copper has stimulated business in copper shares; and the rubber market, after a slight set-back, has made another forward movement on a small quotable scale, but accompanied by a substantial amount of support.

Mexican matters, too, are much less gloomy than they were—at least so far as the financial aspect of them is concerned. Lay readers of the news may be inclined to wonder where the beneficial change in the situation has occurred; but, whatever its cause, the fact remains that practically all securities connected with Mexico have advanced during the past few days. Mexico Tramways bonds of both classes are 5 points higher, and the Firsts are 10 up since the suggestion was thrown out here to the speculator that this particular security offered tempting scope for his peculiar talent. Mexican Light and Power Common are firmer at 20½, the preferred at 42, and the

bonds stand about 46 and 29 for Firsts and Seconds respectively.

Canadian Industrials also are having their turn of better markets. Large orders for British munitions of war have been placed with some of the Canadian undertakings; and Stock Exchange expectation, at any rate, looks hopefully for a wide distribution of the orders already secured and to come. (Incidentally, it may be interpolated that the Edison & Swan Co. is said to be making a new kind of small projectile for use by the British Army.) Canadian General Electric Common shares have strengthened to 91, a gain of several points on the week, and the 7 per cent. preferred rose to 107. A little business is being done in British Columbia Electric Railway issues.

With Mexican and Canadian affairs shaping more cheerily, it is meet that the Brazilian companies should also be advancing in public favour. The dramatic rises which have occurred in Brazil Tractions since Easter were not repeated; but the market is a hard one, and as there were a great many selling orders at 60, the mere touching of this price enabled a good number of them to be executed, leaving the way clear for further advance when the buyers return to the attack. Maybe it is not altogether outside the scope of our province to add that the market for nitrate shares has developed more strength than it has exhibited since the war started, this in its turn producing improvements in Chilean Government and commercial bonds and shares.

The Home Railway market declines to be left behind in the quiet confidence which is acting as a stimulus to securities, investment and speculative alike. Some there are who regard the Government's concession to the railways as likely to turn out of no great value, but that the investing public as a whole do not share this pessimism is shown by the way in which prices of Home Railway stocks are quietly mounting. In this advance Metropolitans have shared to the extent of a point, and Districts are ¼ better; though, on the other hand, there are no changes worth mentioning in Central London or Underground Electric Railways descriptions.

The Telegraph market is good all round. Indo-Europeans went up 4 points to 55. The sellers who had been worrying the market for some little time, pressing shares with a persistence worthy of a better cause, succeeded in getting rid of them; and as soon as these orders were finished, a sharp rebound took place. The Company's repetition of its previous dividend—making £3 5s. for the year—aided the rally. Great Northern Telegraphs are £1 higher at 30, and the company has achieved the noteworthy performance of being able to increase its dividend from 20 to 22 per cent. Anglo-American Telegraph preferred and deferred are both substantially better, declaration of the usual quarterly dividends on the first-named and of 15s. on the ordinary stock having brought in further buyers. Eastern Telegraph rose a point. Western shares went up 5s., and an improvement of 1s. or so in West India and Panama advanced the price of the shares to 26s. 3d. Globe preference hardened to 12¼, so that the yield on these shares is now reduced below 5 per cent. It is not a little surprising that, in the midst of a European war, securities such as those afforded by the telegraph industry should be maintained at prices that yield on the pre-ordinary classes something under 5 per cent. in the case of a good many.

County of London preference again rose ½, while City preference fell ¼ to 12¼, and Metropolitan debenture executed one of its five-point movements, this time in a retrograde direction, the price falling to 75. The Manufacturing group is a little easier, the principal feature being weakness in Edison and Swan shares. The fully-paid are 7s. 6d. lower at 35s., and the partly-paid fell a florin to 12s. 6d. British Westinghouse preference are also a trifle down.

Babcock & Wilcox show reduced profits, which have led to the dividend being lowered to 14 per cent., against 16 per cent. a year ago. The price of the shares at 52s. shows comparatively little change, and the report will re-assure holders of Babcock shares that they need have no fear as to the soundness of their investment. The Vickers report is also out, and the price of the shares hardened a trifle to 37s. 3d. Armstrongs are expected to declare their dividend any day now; some expect 12½ per cent., the same as a year ago; others think the company will increase the distribution to 15 per cent.

Rubber shares have benefited from the expectation that there will be an early rise—to 2s. 6d. at least—in the price of the product; while the December reports now making their appearance show that some of the companies, at any rate, have a good chance of lowering their costs to the neighbourhood of 8d. per lb. The economist will doubtless point to the improbability of an article capable of being placed on the market at 8d. a lb. selling, under normal conditions, at anything like three and a half times that figure; so that those who look ahead have some reason for their faith that rubber will come down eventually. To the strength of the copper market reference has been made already, and most of the leading copper shares have responded to the week's advance in the price of the metal.

Regret and sorrow have been expressed in the Stock Exchange at the sad death of Baron Reuter. Many House firms used to subscribe to a special service of the Agency, and men with the latest "Reuter" were always centres of much attention in exciting times. The price of Reuter's £10 ordinary shares is nominally about 5, but they seldom change hands nowadays.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	April 20, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8½	—	£6 1 8
do. 7 per cent. Pref.	7	7½	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref.	4½	4½	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅞	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14½	—	6 4 2
do. do. 6 per cent. Pref.	6	12½	— ¼	4 18 0
do. do. 5 Deb.	5	113	—	4 9 8
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11⅜ xd	—	6 3 1
do. do. 6 per cent. Pref.	6	11½	+ ⅛	5 4 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	97	—	4 12 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅛	—	6 18 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	8½	8	—	5 16 8
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—5	4 13 4
St. James' and Pall Mall	10	8	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅝	—	5 9 10
do. do. do. 3½ Deb.	3½	80	—	4 7 6
South London	5	3	—	6 18 4
South Metropolitan Pref.	7	1⅝	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅜	—	4 12 4
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	106	+1⅛	5 13 0
do. Def.	1½	23	+1	6 10 4
Chile Telephone	8	6⅜	—	6 0 9
Cuba Sub. Ord.	5½	3⅝	—	6 5 9
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	18	—	5 7 8
do. 4 Deb.	4	99	—	4 7 0
Eastern Tel. Ord.	7	135	+1	5 3 6
do. 3½ Pref.	3½	73½	—	4 15 3
do. 4 Deb.	4	98	—	4 7 0
Globe Tel. and T. Ord.	6	11½	—	5 4 4
do. Pref.	6	12½	+ ½	4 17 2
Gt. Northern Tel.	22	30	+1	7 6 8
Indo-European	65/-	55	+4	6 0 0
Marconi	20	17	—	10 18 4
New York Tel. 4½	4½	99½	+ ½	4 10 3
Oriental Telephone Ord.	10	9	—	6 0 0
do. Pref.	6	1⅜	—	5 1 1
Tel. Egypt Deb.	4½	88½	—	5 1 8
United R. Plate Tel.	8	6½	—	6 8 0
do. Pref.	5	5	—	5 0 0
West India and Pan.	1½	1⅜	+ 1/16	5 0 0
Western Telegraph	7	13⅜	+ ½	5 2 8
do. 4 Deb.	4	93	—	4 6 0
Home Rails.				
Central London, Ord. Assented	4	77	—	5 4 0
Metropolitan	1½	30½	+1	4 2 0
do. District	Nil	17½	+ ½	Nil
Underground Electric Ordinary	Nil	1⅛	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income	6	81	— ½	7 8 3
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4½	—	6 9 5
do. 2nd Pref.	5½	3¾	—	7 2 0
do. 4 Deb.	4	85½	— ½	4 15 9
do. 4½ Deb.	4½	90	—	5 0 0
do. 5 Deb.	5	89	—	5 12 4
Brazil Tractions	6	59	—	10 3 4
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	30	—	Nil
do. 5 per cent. Bonds	Nil	55	+5	Nil
do. 6 per cent. Bonds	Nil	85	+5	Nil
Adelaide Sup. 6 per cent. Pref.	6	5½	—	5 14 3
do. 5 Deb.	5	103	—	4 17 1
Manufacturing Companies.				
Babcock & Wilcox	14	52/-	—	5 7 8
British Westinghouse Pref.	7½	1⅛	— 1/16	7 15 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	99	—	6 1 8
Callenders	15	13	—	8 6 8
do. 5 Pref.	5	4⅞	—	5 2 7
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8⅝	—	4 14 1
Edison & Swan, £8 pd.	Nil	12/6	— 2/-	Nil
do. do. fully paid	Nil	1⅝	— ⅛	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	5	13/6	—	7 5 6
do. do. Pref.	7	1	—	7 0 6
Gen. Elec. Pref.	6	10	—	6 0 0
Henleys	20	14½	—	6 18 0
do. 4½ Pref.	4½	4¼	—	4 12 4
do. 4½ Deb.	4½	97	—	4 13 9
India-Rubber	5	9½	—	5 9 7
Telegraph Con.	20	37	—	5 8 6

Shropshire, Worcestershire and Staffordshire Electric Power Co.—At an extraordinary general meeting to be held on May 3rd, resolutions are to be submitted for the following purposes, says the *Financial Times*:—

(1) Dividing each of the existing £5 shares into shares of £1 each, so that the share capital will consist of 900 000 ordinary shares of £1 each, of which 300 000 shares have been issued and fully-paid up; (2) converting 150,000 unissued ordinary shares of £1 each into 150,000 preference shares of £1 each, entitled to a cumulative dividend of 6 per cent. and to priority for capital without further participation; and (3) authorising the borrowing on mortgage of an amount not exceeding £100,000.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1915.

The returns of electrical export and import business for March show a satisfactory state of affairs from the British manufacturers' point of view.

Thus the exports for the month reached a total value of £391,850, as compared with £256,519 in the previous month, and £364,562 in January.

The imports of electrical material, on the other hand, have gradually fallen off since January, the March total being £203,759, as against £217,500 in the previous month. The re-exports dropped from £24,216 in February to only £8,297 in the month under review.

As regards exports from this country, the improvement in value seems to have been general, but the telegraphic and machinery sections in particular show considerable increases, the lamp sections remaining practically stationary, and carbon exports showing a decline.

Machinery and lamp imports showed a considerable falling off, while cable and telegraphic imports were higher. Imports of electrical material from the United States have been steadily falling off since January, and only reached £129,381 in value in the month under review. Dutch imports—principally lamps—remained at a high level, and French, Italian, and particularly Swiss imports, increased considerably in value in March.

The most prominent purchasers of electrical material from this country were Japan, India, New South Wales and France.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,196	3,625	47	153	285	1,362	4,445	22	194	32	658	3,636	15,645
Germany	...	...	...	...	...	...	...	...	...	...	...	...	...
Netherlands, Java and Dutch Indies ...	486	2,384	883	11	12	28	224	100	468	...	153	345	4,794
Belgium	20	...	...	...	...	...	...	...	...	...	...	...	20
France	1,217	800	1,863	175	36	24	1,668	1,066	846	69	9 629	17.298	34,691
Portugal	203	1,260	71	105	...	651	537	1	...	...	181	1,721	4,740
Spain, Canary Isles and Spanish N. Africa...	187	176	269	16	...	...	576	23	18	...	4	425	1,694
Switzerland, Italy and Austria-Hungary ...	1,182	...	12	...	32	2,278	833	48	18	68	4,161	...	9,172
Greece, Roumania, Turkey and Bulgaria ...	4,112	...	26	27	...	...	...	...	15	...	...	10,175	14,355
Channel Isles, Gibraltar, Malta and Cyprus...	137	119	66	146	...	199	193	...	...	...	...	88	1,543
U.S.A., Philippines and Cuba	892	...	37	...	...	124	1,002	...	18	...	...	210	2,283
Canada and Newfoundland	505	16	597	1,399	...	166	1,910	16	958	...	5	35	5,605
British West Indies and British Guiana ...	19	...	256	91	...	...	745	...	343	...	541	1,297	3,292
Mexico and Central America	44	19	105	79	...	...	27	30	13	...	77	21,000	21,394
Chile	329	1,154	5	357	...	...	500	1	30	...	...	32	2,417
Brazil	42	605	1,168	447	10	163	1,166	38	116	...	...	...	3,755
Peru and Uruguay	...	400	...	40	...	...	37	...	...	...	...	5,005	5,482
Argentina	229	2,754	472	251	...	906	4,335	7,003	904	...	1,842	37	18,733
Colombia, Venezuela, Ecuador and Bolivia...	11	65	3	266	...	...	32	433	...	...	...	589	1,399
Egypt, Tunis and Morocco	387	539	97	61	...	197	1.2 986	9	133	...	196	748	3,663
British West Africa	73	3,631	2	61	...	...	2,0 — 6	15	178	...	161	489	6.626
Rhodesia, O.R.C. and Transvaal	210	1,005	272	552	115	52	629	...	63	...	67	...	2,963
Cape of Good Hope	292	654	837	313	86	251	2 25	4,668	380	33	851	3,297	13.931
Natal	468	3,367	244	320	86	28	2 009	141	78	70	54	55	6 920
Zanzibar, Brit. E. Africa, Mauritius & Aden	133	30	40	95	19	...	...	...	12	...	7	253	589
Azores, Madeira and Portuguese Africa ...	88	81	105	67	...	49	873	...	515	...	50	100	1,928
French African Colonies and Madagascar ...	...	...	...	...	...	...	31	...	...	...	...	...	31
Persia	412	577	1,825	...	55	...	11,526	139	17	...	74	20	13 615
China and Siam	961	1,338	2,353	136	...	349	946	57	486	14	1,256	528	8,404
Japan and Korea	532	...	243	94	...	423	10,072	95	616	26	27	29,419	41,547
India	3,606	6,792	4,649	2,250	65	2,553	13 369	2,743	2,261	206	2,407	59	40,960
Ceylon	198	69	211	...	...	22	587	64	1,066	36	...	557	2,810
Straits Settlements, Fed. Malay States and Sarawak	983	199	941	132	...	570	4.094	51	386	67	15	544	7,982
Hong Kong	494	413	534	13	...	...	1,104	10	12	69	...	...	2,649
West Australia	...	567	239	190	...	1,085	1,822	14	401	...	...	173	4,491
South Australia	168	430	644	56	11	553	2,652	105	31	...	831	383	5.864
Victoria	886	6.154	1,077	712	12	1,083	9,564	947	1,009	71	836	183	22 533
New South Wales	376	8.467	1,682	873	68	1,162	10 237	4.029	9,967	23	1,084	465	38.383
Queensland	146	443	88	145	...	94	1,031	299	45	...	230	239	2,960
Tasmania	...	482	30	97	...	...	112	...	...	...	...	...	721
New Zealand and Fiji Islands	757	675	1,197	878	...	532	3,104	646	459	...	807	1,066	10,121
Total, £	21 986	49.290	23,893	10,608	892	14,914	97,562	23,247	22,056	784	26,147	100,471	391,850

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	133	...	231	11	2,089	...	8,458	546	1,021	1,934	2,458	16,881
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	265	...	...	11,394	525	...	478	...	753	...	23	13,438
Belgium	...	...	...	...	...	...	...	...	...	...	...	...
France	220	320	630	335	138	205	548	60	4,906	1,803	258	9 423
Switzerland	943	270	81	347	266	1,560	19,014	...	...	1,306	...	23 787
Italy	80	8,664	...	...	98	...	116	...	...	114	...	9,072
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	6,098	2,977	1 030	1,048	1.313	208	32,259	73,598	6,831	1,929	2 090	129.381
Total, £	7,739	12.231	1,972	13,135	4.429	1,973	60,873	74,204	13,511	7,086	4,829	201,982

Additional imports.—Spain, glow lamps, £16; carbons, £851; Canada, glow lamps, £20; arc lamps, £253; meters, £50; goods, £40; machinery, £547.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	1,795	62	...	520	...	873	1.873	...	60	232	2,882	8,297

TOTAL EXPORTS: £391,850 TOTAL RE-EXPORTS: £8,297 TOTAL IMPORTS: £203,759

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

REVIEWS.

American Electricians' Handbook: a Reference Book for Practical Electrical Workers. Compiled by Terrell Croft. London: Hill Publishing Co. Price 12s. 6d. net.

The handbook now before us is of what is known as "pocket size," though few will be found to carry such books with them as a habit. It can be put into the pocket when it is desired to take the book on to a job, and we suppose that must be the meaning of the expression.

It consists of six sections, running into 709 pages, of which 19 double-column pages are devoted to the index. This is a good feature, as a complete index is one of the most important parts of a work of reference, such as this book announces itself to be. There are 792 illustrations.

The first section deals with fundamentals, and it is possible that this part of the book is unnecessarily elaborate. Our readers will acquit us of any tendency to belittle the importance of theoretical knowledge to the practical electrical worker for whom the book is designed, but the exposition of somewhat strained hydraulic analogies is of very little value. The inclusion of 36 pages on the properties and splicing of conductors under "fundamentals" is surely an example of extreme latitude as to the meaning of the word.

Some of the definitions given in this section of the book do not fit in with what, in our time, was generally taught in English technical colleges. One example will suffice. Resistivity is the resistance of a centimetre cube of a metal, and is the same as specific resistance. Mr. Croft says that the resistance of a circular mil-foot is often called the resistivity. We do not think it advisable that authors should give meanings of their own to words already in use, although Humpty Dumpty did so in "Alice in Wonderland."

The spelling of "coulomb" as "columb" throughout is probably due to the author's patriotism.

The second section deals with generators and motors, and will be of considerable use to practical men engaged in the installation or repair of this class of machinery.

The third section discusses outside distribution, and the fourth, interior wiring. As in most American books, considerable space is devoted to overhead construction and pole lines, and many useful tables, illustrations and details are given of the apparatus and accessories required in this work. Underground mains also receive a fair share of attention, and it will be found that all the more generally used systems are discussed. In the interior wiring section we are given a list of the standard symbols adopted by the National Contractors' Association and the American Institute of Architects. These seem very useful, and are calculated to save time and to render diagrams and plans more easily understood. We think some such system of conventional signs might well be adopted in this country.

We do not find any consideration of the earthing of metal conduit. It would be well if, in a future edition, instructions were given as to how to make the conduit electrically continuous, and how to earth it, with reasons why, in certain cases, this course is advisable. The suggestion as to an emergency or burglar circuit on page 518 is interesting, being seldom if ever met with here.

Reference is made on page 537 to bell-ringing transformers, and the author says: "A bell-ringing transformer meter, a good one, will last for ever." We are not quite sure what is meant by this. So far as we know there is only one alternating-current meter which combines a transformer for bells with its normal functions. This is of a Continental type, and when introduced into Great Britain did not seem to fill any felt want. Further, it is scarcely in the hands of the consumer or his contractor to choose what meter shall be put in. That is the business of the supply authority.

Transformers are dealt with in Sec. 5, and persons dealing with such apparatus will find much assistance from it. We may remark, in passing, that in fig. 48, page 631, a *sash*-pot is shown. This should presumably be *dash*-pot. As in the earlier section on outside distribution, much attention is given to overhead work and the fixing of transformers on poles.

The sixth and last section deals with illumination, but tells us nothing new. We are rather glad to see that the system of indirect lighting is not laboured so much as has been the tendency in recent years. A little diffusion is very pleasant, but too much of it is very trying.

The compilation of such a handbook is a matter of considerable labour, and, on the whole, the author has performed it well.

American Handbook for Electrical Engineers. By Harold Pender, Editor-in-Chief. London: Chapman & Hall, Ltd. Price 21s. net.

A handbook is presumably a cross between a pocket-book and an encyclopædia. At any rate, such is the impression one naturally receives at a first glance through the present work. It contains more than 2,000 pages of closely-printed matter, and, as a reference book for practising engineers and students of engineering, exceeds, with regard to quantity of material, anything we have hitherto come across. Its editor-in-chief is Professor of Electrical Engineering at the University of Pennsylvania, and he has had associated with him 26 assistant and associate editors, all experts in the various branches of which they treat. Nor does the book confine itself to electrical engineering only, for it includes a great mass of data on those mechanical and civil details which are in any way related to the electrical, and with which up-to-date electrical engineers would be expected to keep in touch.

The work, in addition to being remarkable for the great quantity of matter it contains, has several novel features incorporated with it. As the book is primarily intended for the practising engineer, all theoretical discussions have been segregated into separate articles, and only sufficient theory is given in subjects dealing with practical matters to render the context plain. Numerous mathematical tables and relations are given, among which may be mentioned articles on logarithms, trigonometric functions, hyperbolic functions, exponential functions, derivatives, integrals, indeterminate forms and equations. The matter is arranged in encyclopædic fashion; that is, the articles are taken in alphabetical order, an arrangement which appears to us eminently reasonable in consideration of the vast quantity of data presented. One plan of treatment has been followed wherever possible, the method especially applying to articles dealing with apparatus and machinery, as follows:—(*a*) General description and definitions; (*b*) brief statement of application; (*c*) principle of operation; (*d*) design; (*e*) testing; (*f*) performance; (*g*) specifications; (*h*) installation; (*i*) operation; (*j*) dimensions, weights and costs; (*k*) bibliography.

Cost data have received much attention, and the editor very justly points out in this connection that students and recent technical graduates are sadly lacking in even the roughest idea of the price of apparatus and structures; it is chiefly to supply a rough idea of such costs that the cost curves and figures are given wherever possible. For it is the hope of those who have compiled the volume that teachers in technical schools may find many of the articles suitable as bases for courses of lectures. We are inclined to think that this desire has been successfully achieved, more especially in the electrical than in the mechanical and civil departments, and that teachers will find the book of great help in preparing lessons which will contain the gist of the matter under consideration uninvolved by cloying masses of by-products. The bibliography at the end of each article is also very useful, but it is only intended to direct the reader to more extended information in treatises and current periodicals and does not make any pretence to completeness.

The preparation of the volume has occupied approximately three years, and none of the plates were cast until the summer of 1914. Before casting, all the galleys were revised, and in some instances large sections of the articles were re-written.

Such a work, involving as it does a tremendous amount of labour and care, it were almost invidious to criticise. The perfect condensing down of subjects interconnected like those of engineering, so that nothing essential is omitted and nothing superfluous admitted, is a task at which the superman might very reasonably quail. And it is going far to say that this condensing down has

been generally done, in the present case, with method and acumen.

The brevities of the pocket-book and the verbosities of the text-book have both been evaded, and the result is something that has real and lasting value. Perhaps under the title of Electron Theory a little more might have been given, as this particular subject appears to us, especially in view of its comparative newness and its undoubted importance for the future, to have been unduly condensed. Likewise, under the headings Steam and Thermodynamics, a little fuller explanation might have been supplied regarding entropy and its applications and the entropy chart in general, and perhaps a few typical problems might have been briefly worked out. But these are details which detract little from the value of the work as a whole. The handbook is well worth its price, though the purchaser, of course, has to remember that it is written from the American point of view and agreeable to the practice of that country.—W. J. C.

Laboratory Course in Electrochemistry. By Oliver P. Watts. 1914. London: Hill Publishing Co. Price 4s. 2d. net.

This small volume of practical methods of electrochemistry forms a very useful addition to the ever-increasing bulk of this branch of Science. It is intended for students who have access to an up-to-date laboratory equipment, and for use as a supplement to explanatory text-books. The author opens with a short preface, in which he states that the manual has been designed primarily for his classes in the University of Wisconsin, but he hopes that it will also be of use elsewhere. The introduction contains a short account of the necessary laboratory equipment, based on the apparatus at the disposal of the author. This description, although interesting, is too brief to be of great utility. Many useful hints are contained in this section of the book, but its undoubted value is impaired by lack of detail. The author then continues with the usual stock instructions to students, which are admittedly beneficial when carried out.

The experimental part of the book is introduced after this point. This section constitutes the chief feature of the manual, and contains 133 selected experiments. Each one is clearly and simply described, but no explanation of the expected result is given, although apposite questions are asked to test the student's comprehension of his subject. It is clear, therefore, that this manual is intended chiefly for students working under tuition, its main object being to induce a careful analysis of the results.

The first experiments illustrate the phenomena accompanying the electrolysis of aqueous solutions, which naturally include the resistivity of electrolytes and errors due to polarisation. Faraday's law is clearly elucidated, and is followed by a demonstration of the use of coulombmeters.

The next pages are devoted to the measurement of electromotive force, and in this section the author describes a very simple and cheap form of potentiometer, which is well worth copying. Experiments illustrating the phenomena of over-voltage and passivity are included here.

The corrosion of metals is next dealt with, preceding a description of the separation of metals from alloys and complex solutions. There is also a very brief account of electrochemical methods of analysis, but this is intentionally incomplete.

A considerable section of the book is devoted to electroplating, and the electrodeposition of pure metals and alloys. There are also numerous recipes for the colouring of metals. These are without doubt of great interest, but scarcely come within the scope of a manual devoted to electrochemistry.

The concluding experiments describe the preparation of a few inorganic compounds. The book closes with an appendix of tables and an index. The experiments are copiously illustrated with diagrams and curves. The treatment is simple but clear throughout, and the book undoubtedly forms a very useful addition to our electrochemical literature, and may be recommended with confidence to all students desiring a general knowledge of practical electrochemistry.

MAIN-LINE SIGNALLING ON RAILWAYS.

By W. C. Acfield.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, March 31st*, 1915.)

(*Concluded from page* 567.)

Semi-automatic signalling.—This term denotes a manual system of control in combination with an automatic signalling system, by which signals placed beyond the limits of ordinary working are controlled partly from a signal-box and partly by track-circuited lines. It is used for splitting up long block sections, the control from the signal-box enabling the customary "normal danger" system to be maintained on steam-operated railways. The portion of the line between the starting or advance signals of the rear and the home signal of the advance sections is divided up, and the semi-automatic stop and distant signals are placed in the most suitable positions to suit the gradients. There are two ways of dealing with the problem, viz.:—

(a) By making the semi-automatic signal act as an advance signal to the rear section, in which case ordinary block working is maintained.

(b) By making the semi-automatic signal act as an outer home signal to the advance section (see fig.4), in which case the ordinary block system between the rear and advance signal-boxes is dispensed with and the traffic is worked by bell code-signals.

The latter system has certain advantages over the former, inasmuch as a train entering the semi-automatic area is more under control of the advance signalman, because, in the case of a train over-running signals, the advance signalman has the opportunity of stopping the train by placing detonators on the line in cases of emergency. Moreover, a bell code is more convenient than a block system. In either system the track circuits are divided up, and in order to comply with the standard clearance regulation the usual overlap of a quarter of a mile is provided to all signals in the semi-automatic area, the signals being replaced to danger upon the train leaving a track-circuited section.

It is not advisable to work semi-automatic signals a long distance from signal-boxes on account of the difficulty in regulating wires affected by temperature variations; the signals are therefore worked by motors, controlled by switches on the levers in the signal-boxes.

Fig. 5 shows the form of track indicators for semi-automatic signalling, as used on the Midland Railway. In semi-automatic signals such as those described, a difficulty must arise in foggy weather in getting fog-men to the distant signals, and in order to safeguard against such conditions instructions are issued that semi-automatic signals must not be relied upon, but means are not generally used to enforce the instructions. The case can, however, be met, with small extra expense, by providing what is termed a fog lever in the signal-box in advance, which upon being pulled over links up the various track-circuited sections as one long section and renders it compulsory for the signalman to lower the semi-automatic signals before the starting signal in the rear can be lowered for a train to leave that section.

The term semi-automatic is also applied to signals of automatic-signalling installations where there are crossover roads or connections with sidings worked manually or by power from a signal-box; but so long as the points are not used the signals continue to be operated by the passing of trains over the track-circuited lines.

This arrangement is very flexible in working and can be adapted to manual interlocking frames of the ordinary pattern, the points being operated by rodding as usual and the signals electrically, the signal lever when reversed closing a contact in the signal circuit. The signal circuits are so arranged that when it is unnecessary to operate the points, the signal levers may be and are generally left in the reverse position; the signal control is then governed solely by the track-circuited lines to which the signals apply and becomes entirely automatic, thus enabling block or lock-and-block instruments to be dispensed with. This has the merit of enabling existing signal-boxes and locking frames to be retained, where necessity arises, when installing automatic signalling on steam or electrified lines, and very considerably reduces the cost of installation, as against "scrapping" existing locking frames and providing power frames working points. It thus places the reconstruction of signalling systems within reasonable reach of railway companies at a comparatively lower cost.

Automatic signalling.—The object to be attained by the use of automatic signals, unlike that of manual block signals, is to compel a signal being put to danger behind each train on a double line of railway, and cause it to remain in that position until the train has gone a certain distance beyond that signal. In the case of single lines the same object is attained, with the addition that at all times a signal governing movements in the direction opposite to that in which the train is moving must be displayed in the danger position some distance ahead of the train.

Automatic signalling is an admirable substitute for the block system, the signal movements being governed by electric or pneumatic agency, controlled by the passage of a train into, through, and out of the block section to which the signals apply; this is effected by the action of the train alone

operating the track-circuited sections of the lines controlling such signals, the ideal arrangement of automatic signals being such as to secure the maximum capacity for train movements over a given length of line, bearing in mind the effect of gradients and curves on the traffic. Two systems of automatic signalling are used, viz.:—

(a) Normally danger.
(b) Normally clear.

The normally danger system, in which the signal stands continually at danger except when trains are required to pass along the line, agrees with the normal position of a mechanical or manual system, and complies with the standard practice of the block regulations as laid down for traffic working. After being placed to danger by the train entering the section, the signals remain in that position until they require lowering for the following train, this being done by the approaching train lowering the signals if the section ahead is not occupied for traffic in the same direction. This system necessitates greater complications in the electrical connections, as the track circuits have to be so arranged as to lower the signals in addition to replacing them to danger.

In normally clear systems the entering of a train into the track-circuited section places the signal in the rear to danger, and the clearing of the block section, by the passage of the rear wheels of the train out of it, resets that signal to the clear position, ready for a following train in the same direction to approach. Those in favour of this system contend that the electrical connections are fewer and more simple, and from a maintenance point of view less costly. There is much to be said in favour of the normally clear system, because, after all, automatic signals differ considerably from mechanical or manual systems, as they simply indicate to drivers that the section or sections ahead are clear and are an indication of the condition of the line ahead.

In all automatic-signalling installations there is the risk of trains being unduly delayed at signals in the event of failure of the apparatus, in which case the signal would remain at danger. To provide against such a contingency it is customary to allow drivers to pass the signal in the danger position after coming to a stand and waiting a prescribed time, as laid down in the rules and regulations of working. After starting again the driver is allowed to proceed cautiously, being prepared to stop at or before reaching the next signal. If the next signal is at clear he may proceed at regular speed until reaching the next signal at danger.

Fig. 6 shows an arrangement of automatic signals for one road on a double line of railway. Single lines of railway can be worked by means of automatic signalling instead of by train staff or tablet systems, but up to the present the author is not aware that such an arrangement is in use in this country.

Overlaps.—These consist of an extension of a track circuit from 100 to 440 yards ahead of a signal, such track circuit and its extension, when occupied, securing the signal in the rear at danger.

Overlaps are used to guarantee that a space is provided between one train, standing at or passing a signal, and another train in the rear—instead of relying on the thickness of a signal post to give protection—and comply with the regulation that a second train must not be allowed to approach the rear signal until the preceding train has passed at least a quarter of a mile beyond the governing signal. Thus the track circuit between two signals extends ahead of the signal, from 100 yards to 440 yards, the length being regulated to suit the gradients, speeds, and curves of the railways, whether steam or electrified working is in operation.

Power signalling.—This is a means of operating an interlocking system of points and signals by some form of power other than manual, in which levers for moving points or signals by levers, rods, and wires, are supplanted by levers or slides which close or open valves or electric circuits. The levers or slides are small and are placed close together, so that the length of locking frames and signal-boxes is at once reduced, and they can be placed in confined places, without disturbing the lay-out of the roads in large stations or yards.

There are many advantages in power-working as against other methods, as several sets of points can, if necessary, be operated by one lever, and more than one signal can be operated per lever by the aid of a selector arrangement, so that on the whole the total number of working levers can be very materially reduced.

There is a further advantage attained in relation to facing points, as the Board of Trade requirements in regard to the maximum distance for working the same by power have been relaxed, this distance being extended to 300 yards from the signal-box. This concession alone is most helpful in the laying out and planning of works, and thus recommends itself to railway engineers.

The essential features of a power system are that the operation of all points and signals, etc., must be ensured, and that the possibility of any movement not being completed must be guarded against.

In power systems the locking in one direction must be counter-locked in the other direction. For instance, the fact of releasing a bolt lock on a ground frame does not prevent the lever effecting the release being replaced; and therefore the lever in the ground frame thus released and working the points must in a like manner operate a back-lock on the lever in the signal-box. Detection of signals and points is, however, easier and more elastic than in manual systems on account of the absence of the regulation of wire connections, and lends itself to overcome many difficulties experienced in the manual system.

A large number of signal-boxes have been installed in England, and the largest installation is stated to be that at the Glasgow Central Station of the Caledonian Railway. It consists of 338 working levers controlling 112 points and 245 signals, and has proved its value. The levers in the locking frame, after being moved sufficiently far to operate the points, cannot be moved completely over, owing to a stop termed a "check lock," which is electrically removed when the points have gone properly over, after which the lever is free to be moved over completely. The mechanical locking of the tappet type then allows the necessary signal levers to be pulled over. If for some reason due to the points not working properly, the point lever cannot be moved right over, the signals for the particular route cannot be lowered. A somewhat similar arrangement is provided on the points, and compels the signal being properly placed to danger before the signal lever can be restored completely to its normal position. The signalman is thus advised of any failure due to the signal not going to danger, and locks up the apparatus so that further movements are impossible.

The mechanism for operating the points is placed outside the 4-ft. way, and consists of an escapement bell crank, the plain end being connected to the stretcher rod of the points, and the escapement end operated by means of a slide with a projection or roller connected to the piston rod. Air is admitted to the cylinder at one or the other end and gives the necessary movement to the slide operating the bell crank, which is also connected to the locking bar. The total movement of the slide produces three distinct movements of the mechanism: first, the locking bar is lifted; secondly, the points are moved; and thirdly, the locking bar is lowered. It therefore follows that if any wheels are on the locking bar the points cannot be moved.

Electrical detectors are connected to the tongues of the points, thus ensuring that the points are completely set in one direction or the other, and they indicate to the signalman that the points are properly over, by the clearing of the stop on the previously mentioned lever in the signal-box. The operation of signals is somewhat on the same lines, air being admitted into one end of the working cylinder by means of pin valves operated by electro-magnets.

In electro-pneumatic installations where the lines are track-circuited, illuminated diagrams are installed instead of the signal-box diagrams usually provided. The roads, points, and signals are exhibited on glass which is opaque all over except the roads. Electric lamps are placed behind the roads in the diagram, and are partitioned off in lengths to correspond with the track-circuited sections, and are so controlled by the track-

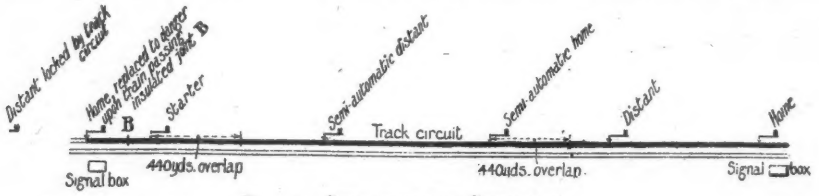


Fig. 4.—Semi-automatic Signalling.

Fig. 5.—Track Circuit Indicator.

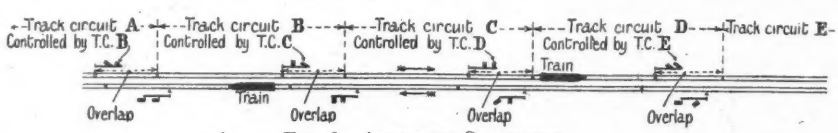


Fig. 6.—Automatic Signalling.

circuit relays as to be always alight, except when the circuit is opened owing to the presence of a train in the section. When the lights go out the signalman is advised, by the darkened portion of the roads, that the section is occupied. By this means the signalmen in the signal-boxes from which the points (or signals in some cases) cannot be seen, are able to perform their duties, and are yet able to cope with the traffic although the latter is practically hidden from view. It also enables the signals and points to be manipulated with remarkable rapidity.

All-electric systems.—In view of the perfected electric motors now in use, and the fact that only one kind of power is desirable, this system recommends itself to the signalling world generally. The point mechanism in all cases is operated by motors, and the signals by motors in some types and solenoids in others; but the general tendency is to use motors for all purposes.

There has been a great deal of discussion as to the use of "check-lock-return-indication" *versus* "constant-detection." The check-lock, as previously described, prevents the signalman pulling the lever in the signal-box completely over, or restoring the same until the return-indication has removed the lock on the lever, whereas in constant-detection the lever can be pulled completely over without having to wait for the return-indication. This alone must expedite the signalman's movements and enable the work to be done with greater rapidity. The constant-detection breaks down all signal circuits from the moment the lever in the signal-box is moved from one position to the other until the points have been properly operated, and should any points be moved or interfered with by accident or design, the signal circuits affected by the position of the points cause the signals to go to danger, if off, or to be held at danger as the case may be.

A great advantage of the constant-detection principle, although the system is perhaps more costly in installation, is that it enables a failure of detectors to be easily located, and thus saves much running about on the part of the signal fitters and consequent loss of time. From experience of others it may be contended that this method is preferable, as most troubles can be located in the lever frame in the signal-box instead of having to be sought for on the ground. This perhaps will appeal generally as one of the vital points of power signalling, as electricity is doubtless the coming motive power for operating points and signals.

All-electric system with dynamic indication.—This interlocking system is a somewhat novel departure from other systems of power-worked installations as regards the means of detecting in the locking frame the normal and reversed positions of the points, in order to make certain that the movement of the points corresponds with the position of the lever in the signal-box.

The stroke of the lever is divided into two movements. The first movement locks all conflicting levers and operates the point mechanism; but in the second and final movement the stroke of the lever can only be completed when the point mechanism has done its work in operating the points. This final movement can be made after, and only after, the dynamic indication has been received certifying that the operated function has assumed a position corresponding with that of the lever in the signal-box.

When the points are to be operated the first movement of the stroke of the lever in the signal-box permits current to flow to the motor, thereby causing the mechanism to move the points to the opposite position and lock them in that position. When this movement has been completed, the circuit through the switch motor is automatically changed, the motor being disconnected from the battery and connected in a closed circuit including the indication magnet. At the same time the armature terminals are reversed for indication purposes, this leaving the motor connections in the proper position for the next operation. The motor now becomes a dynamo, and with the momentum acquired during the operation of the point movement generates a momentary current which energises the indication magnet, this permitting the final movement of the lever in the signal-box to be completed, releasing such levers hitherto locked. The movement of the points can be reversed at any portion of the travel by the operator at will, and the lever movement completed upon the points assuming a position corresponding with that of the lever, irrespective of the direction of the first movement made by the lever.

The complete point operation, and the final movement of the lever, can be accomplished in from 2 to 2½ seconds, the indication being practically instantaneous with the completion of the point operation.

The indication that the points have moved correctly is given by a current generated by the momentum of the motor, and can therefore be obtained only after the actual operation of the point mechanism, no additional power being required for the indication that the points are properly set to allow of the required signals being lowered to give permission for a train to proceed.

Discussion.

Mr. A. Hurst (President of the Institution of Signal Engineers), in opening the discussion, explained a fundamental difficulty of designing signal apparatus which was due to the necessity of making it comply with conflicting conditions. When high and low speed traffic passed over the same rails, the signalling must be suited to the requirements of the high-speed traffic, and this was not always the most suitable for low-speed traffic. Ideally, two distinct systems of signalling were required to suit the two cases, but this was not practical, and in consequence the design of signal systems resolved itself into finding the best compromise. With regard to electrical apparatus, the engineer must not think that because his apparatus worked well in the laboratory it would also work well on the road, because disturbing factors were often found in practice which were not suspected until failure was experienced under actual working conditions. As an instance of this kind of thing, he mentioned that if the engineer in repairing a line put in a new length of rail, the electric signalling apparatus ceased to operate until the skin of the rail had been removed.

Mr. A. F. Bound mentioned that in all-electric signalling one unit of energy would operate from 500 to 600 signals.

Dr. Kapp demonstrated a model of the Railophone method of signalling and explained the operation of the Kapp-Kramer relay.

Mr. T. S. Lascelles (communicated) said that enthusiasts for power signalling schemes fell into the error of supposing that men could be reduced to a negligible quantity and the speed of working vastly increased. The electro-mechanical system now being extensively adopted in the U.S.A. enable many of the advantages of power signalling to be obtained without the troubles of maintenance and operation that were liable to attach to power-worked points.

Mr. W. J. Thorrowgood (communicated) stated that the advantages of track circuits were obvious, and no doubt extensive use would be made of them in future. The weak spot was the fact that there were a number of vehicles fitted with Mansell wheels (*i.e.*, wooden block wheels). Such wheels failed to operate the track circuit apparatus. The difficulty could be overcome by bonding the hub to the rim. The use of sand by drivers should be discouraged, as the accumulation of sand on the rail was likely to introduce considerable resistance between the rail and rim of the wheel and thus cause even a heavy engine to fail to operate a track circuit.

Mr. A. E. Tattersall (communicated) stated that in his opinion the alternating-current system would eventually supplant the direct-current in track circuiting in this country, especially in large installations, for the following reasons: (1) It afforded an economical system of power transmission, and the main could be utilised for other purposes than signalling, such as power and lighting; (2) the question of track insulation did not enter to nearly such a large extent as in direct-current systems; (3) extraneous currents could be fully guarded against by using suitable frequency relays or employing some form of apparatus embodying the principle of resonance.

Mr. Whysall (communicated), in referring to the author's statement as to the debatability of a signalman being able to attend to more roads under power systems than under manual signals, referred to the fact that during the rush hours on the District Railway 98 trains per hour were passed through Earl's Court Station. There were four roads through this station. All these trains were signalled by one man operating a power frame. A signalman doing the same work with a manual frame would be exhausted towards the end of his shift.

TRADE STATISTICS OF SIAM.

The following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1914, are taken from the recently issued official trade statistics; the figures for the year ended March, 1913, are included for purposes of comparison and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong Kong are for the most part the products of other countries shipped *via* these two ports.

	1912-13. Ticals.	1913-14. Ticals.	Inc. or dec. Ticals.
Parts of lamps.—			
From Singapore	3,000	17,000	+ 14,000
,, Hong Kong	—	6,000	+ 6,000
,, United Kingdom ...	32,000	22,000	− 10,000
,, Germany	18,000	21,000	+ 3,000
,, United States ...	7,000	5,000	− 2,000
,, Other countries ...	13,000	14,000	+ 1,000
Total	73,000	85,000	+ 12,000
Lamps.—			
From Singapore	13,000	58,000	+ 45,000
,, Hong Kong	—	33,000	+ 33,000
,, United Kingdom ...	46,000	66,000	+ 20,000
,, Germany	67,000	50,000	− 17,000
,, United States ...	2,000	3,000	+ 1,000
,, Japan	114,000	93,000	− 21,000
,, Other countries ...	15,000	7,000	− 8,000
Total	257,000	310,000	+ 53,000

	1912-13. Ticals.	1913-14. Ticals.	Inc. or dec. Ticals.
Electrical goods and apparatus.—			
From United Kingdom ...	136,000	297,000	+ 161,000
,, Germany	412,000	575,000	+ 163,000
,, United States ...	37,000	155,000	+ 118,000
,, Singapore	2,000	24,000	+ 22,000
,, Sweden	6,000	2,000	− 4,000
,, Italy	14,000	12,000	− 2,000
,, Austria	—	5,000	+ 5,000
,, Holland	2,000	1,000	− 1,000
,, France	2,000	25,000	+ 23,000
,, Japan	3,000	1,000	− 2,000
,, Other countries ...	4,000	27,000	+ 23,000
Total	618,000	1,124,000	+ 506,000
Scientific instruments and apparatus.—			
From United Kingdom ...		36,000	—
,, Germany	Not	92,000	—
,, Austria	shown	11,000	—
,, Other countries ...	separately	39,000	—
Total	—	178,000	—
Manufactures of brass.—			
From Hong Kong ...	10,000	469,000	+ 459,000
,, United Kingdom ...	76,000	58,000	− 18,000
,, China	317,000	102,000	− 215,000
,, Germany	44,000	76,000	+ 32,000
,, Japan	26,000	12,000	− 14,000
,, Other countries ...	16,000	51,000	+ 35,000
Total	489,000	768,000	+ 279,000
Manufactures of copper.—			
From Hong Kong	4,000	2,000	− 2,000
,, United Kingdom ...	41,000	22,000	− 19,000
,, China	74,000	—	− 74,000
,, Other countries ...	10,000	34,000	+ 24,000
Total	129,000	58,000	− 71,000
Steam machinery other than milling and marine.—			
From United Kingdom ...	877,000		—
,, Germany	90,000		—
,, United States ...	—		—
,, Other countries ...	26,000		—
Total	993,000		—
Machinery other than steam.—			
From United Kingdom ...	217,000		—
,, Germany	60,000		—
,, United States ...	46,000		—
,, France	6,000		—
,, Other countries ...	66,000		—
Total	395,000		—
Rail locomotives.—			
From United Kingdom ...		9,000	—
,, Germany		89,000	—
Prime movers other than road locos., marine, milling and agricultural machinery.—		98,000	—
From United Kingdom ...		113,000	—
,, United States ...		23,000	—
,, Germany		6,000	—
,, Other countries ...		5,000	—
Total		147,000	—
Machinery unenumerated, including detached parts, and not including textile or sewing machines.—			
From United Kingdom ...		881,000	—
,, Germany		124,000	—
,, United States ...		56,000	—
,, Other countries ...		33,000	—
Total		1,094,000	—
Machine belting.—			
From United Kingdom ...	33,000	59,000	+ 26,000
,, Germany	22,000	33,000	+ 11,000
,, Other countries ...	3,000	3,000	—
Total	58,000	95,000	+ 37,000
Iron and steel wire manufactures.—			
From United Kingdom ...	47,000	49,000	+ 2,000
,, Germany	83,000	23,000	− 60,000
,, Belgium	108,000	17,000	− 91,000
,, Other countries ...	20,000	12,000	− 8,000
Total	258,000	101,000	− 157,000

See below for new classification.

See above for old classification.

	1912-13. Tcals.	1913-14. Tcals.	Inc. or dec. Tcals.
Railway material.—			
From United Kingdom ...	848,000	336,000	− 512,000
,, Germany	669,000	302,000	− 367,000
,, Belgium	88,000	76,000	− 12,000
,, United States ...	1,000	617,000	+ 616,000
,, Other countries ...	9,000	44,000	+ 35,000
Total	1,615,000*	1,375,000	− 240,000

* Included cars or trucks for railways or tramways.

Cars or trucks for railways or tramways.—			
From Germany	Included	165,000	—
,, United Kingdom ...	under	44,000	—
,, United States ...	railway	8,000	—
,, Other countries ...	material.	3,000	—
Total	—	220,000	—
Caoutchouc manufactures, other than tires.—			
From Singapore		46,000	—
,, United Kingdom ...	Not	41,000	—
,, Germany	shown	14,000	—
,, Other countries ...	separately.	6,000	—
Total	—	107,000	—

Note: £1 = about 13 ticals.

TRAIN DISPATCHING BY WIRELESS.

In a paper on "Train Dispatching by Wireless," read at the New York Railroad Club, on February 19th, by Mr. L. B. Foley, superintendent of telegraph, telephone and wireless, Lackawanna Railroad, New York, the following statements were made:—

"The wireless apparatus aboard the train is of one kilowatt rating, and similar in principle and operation to that at the fixed stations. The motor-generator on the train is operated on thirty volts direct current from the car-lighting generator, which carries on its line a set of storage cells. This motor-generator draws about forty amperes, and provides 500-cycle alternating current at 250 volts for the radio transmitter, including a ten-unit quenching gap, three glass-jar condensers of .002 microfarad each, and the usual radio frequency transformers. The antenna current is about thirty-five amperes.

"We can communicate from a moving train to a fixed station a distance of 130 miles. Owing to the low antenna of the passenger cars, we have not as yet been able to transmit a greater distance from the train, but are able to receive messages on the train from a fixed station at a distance of 200 miles. On the train the aerial or antenna is formed of phosphor-bronze wire arranged in four rectangles, one on the roof of each of the four forward cars lengthwise, with an additional wire lengthwise, and all parallel with the top of the car, each rectangle being carried on porcelain insulators at the corners and centre of each car, with wire link connections between the cars. The wires clear the top of the cars about eighteen inches, being low on account of bridges and overhead interferences; therefore the radiating power is limited. The lead is taken from the middle of the train antenna through the inside of the car, near the roof, into a compartment two by four feet, which contains the wireless telegraph apparatus and the operator.

"The required voltage was obtained from the train-lighting system, and after the first trip on the train it was found that the operation of the train installation did not in any way interfere with the track signals. The speed of the train, or its change of direction while en route, does not have any effect on the transmission or reception of signals, and communication to and from the train is not retarded while the train is passing through tunnels.

"The train radio service has been used for various purposes, such as reporting the number of passengers on board destined to connecting lines, for providing additional cars, or cutting out cars at divisional points, or ordering an ambulance at next train stop for persons taken ill on the train. Commercial telegrams for passengers are handled. In one instance a telegram was filed by a passenger on the train for a resident in the city of Scranton, the message transmitted to destination, delivered, and the reply received by the sender in twenty minutes.

"The wireless telegraph can be depended on between fixed stations, and between moving trains and fixed stations. There are many uses for the wireless telegraph in railroad train operation. It enables the dispatcher to communicate direct with the train, and train orders can be transmitted as accurately and reliably as by telegraph or telephone. The wireless, together with a selective device, can also be used for setting signals at distant points.

"The wireless telegraph serves as an auxiliary method of communication, in addition to the telegraph and telephone, in the event of interruption to wire facilities, and has already proved its practicability and efficiency under such conditions.

not only between fixed stations, but also between a moving train and fixed stations, and the results obtained by the Lackawanna during the past year have been valuable in many ways. It is the company's intention to extend the service over the entire system.

"We have not found it necessary to go outside of our own organisation to obtain operators that can handle wireless equipment and wireless messages. Our wireless office at each divisional point is located within a few feet of the dispatcher's office; and in the event of total wire failures on any part of the road, the wireless is immediately resorted to, operators at divisional headquarters being instructed to listen for a period of five minutes, and if no one is calling, then to call the nearest wireless station for a period of five minutes. This results in the various stations getting into communication with each other in a very few moments. We no longer fear sleet storms, which are becoming more frequent, and which annihilate pole lines of the strongest construction.

"The fact that we are obliged to carry a telegraph operator on each train equipped with wireless telegraphy, or employ a trainman that is a telegrapher, led us to take up the development of the wireless telephone. We have obtained some favourable results, having talked from a fixed station to a moving train a distance of fifty-three miles."—*Telegraph and Telephone Age.*

[The Lackawanna installations were described in our issue of March 20th, 1914.—EDS. ELEC. REV.]

EUROPEAN MARKETS FOR ELECTRICAL SUPPLIES.

THE following are extracts from certain reports which have recently been collected by the American Government from Consular Officers in various centres for the benefit of the electrical manufacturing firms in the United States. The main portions of these reports have not been published, but are being reserved for inspection by American firms.

GREECE (SALONICA).—Recent political changes which have brought Macedonia under the control of a people imbued with progressive ideas constitute a factor favourable to the extension of trade in modern technical appliances of all kinds. Salonica, the commercial centre of Macedonia, is the only city in the Province which at present has an electrical plant. Current is generated by three crude oil engine sets, which have a current-producing capacity of 2,400 H.P.

A Belgian company operates the local power plant, as well as the tramway and municipal lighting systems. (The cars used on the tramway were built by a well-known American concern.) In the past nearly all of the company's electrical supplies have been imported from Belgium. As the trade of that country is now paralysed, it would seem an opportune time for manufacturers to place themselves in communication with this firm. In Salonica electricity is used less than other agents for illuminating purposes, candles, petroleum, and gas predominating. There can be noticed, however, a steady increase in the employment of modern methods of lighting; shops, cafés, hotels, and some of the newer residences have electrical installations, and a slight gain is evident in the use of electric bells and private telephones. Salonica has no public telephone service; it is thought that if such service is installed it will probably be undertaken either by the Government or under strict Government supervision. The European war has brought all local construction work to a standstill, and until more normal conditions prevail there will be little opportunity for large sales of electrical materials in this district. This state of affairs, however, should not deter manufacturers from taking an immediate interest in this market and from bringing their products to the attention of the prospective buyers. Entering into consideration are telephones and all construction materials, wire and cable, arc lights, electric lamps, ceiling, wall, and stand fixtures of inexpensive material, wiring supplies, bell systems, annunciators, and novelties, constructed for a minimum of 220 volts, direct current. Local dealers in electrical materials have imported in the past from Germany, Belgium, and Austria-Hungary, but are willing to purchase from America provided the terms offered are as favourable as those of European manufacturers. No special electrical apparatus is in demand here, but some dealers have expressed a desire to place upon this market a line of electrical novelties, such as curling irons, toasters, hot plates, and sadirons, all of which are not well introduced as yet. A concession has been granted recently to a group of English capitalists to construct an electric plant capable of developing 60,000 candle-power at Cavalla, the Macedonian city, ranking next to Salonica in importance. The plant is to be owned and operated by the company, but the municipality reserves the right to purchase the installation at any time after ten years' operation.

The religious community of Mount Athos, Macedonia, is contemplating giving a franchise to a Greek syndicate to install an electric light plant at that place. Still another town in Macedonia is considering the erection of an electric light and power plant, but the plans therefor have not yet matured. Hydro-electric development has not yet been attempted in Macedonia. Several spinning and flour mills are operated on a small scale by simple hydraulic power. It has been estimated by engineers that waterfalls in Macedonia are capable of producing a total hydraulic force of 20,000 H.P., while only 4,140 H.P. are now being used. When economic and political conditions in the country are dennitely adjusted the hydraulic energy now going to waste will doubtless be directed into commercial channels. Most of the mill-owners are not now inclined to install electrical machinery, which, they claim, is unnecessary and expensive. One or two millers, however, have expressed the opinion that hydro-electric machinery could be profitably employed. Firms seriously contemplating the introduction of electrical goods in this district could not do better than send thoroughly competent representatives, who speak French, to consider the situation at first-hand. The next best method of entering this market is through correspondence, descriptive literature, etc., in French. Importers prefer quotations c.i.f. Salonica. Under normal conditions terms would be part-cash with order—sufficient to cover freight and expenses—and the balance cash against documents on arrival of merchandise.

SCOTLAND (GLASGOW).—There is at present an unusual opportunity for the sale of electrical scientific instruments in Glasgow, due to the fact that in the past nearly all such instruments were imported from the Continent. The same may be said of tungsten filament lamps which, prior to the war, came principally from Germany and Austria. The supply of tungsten on hand is said to be all but exhausted. Another product that is affected by present conditions, and one that offers American manufacturers an excellent opening, is the arc light carbon electrode. Owing to the elimination of Continental competition, the local selling price of carbons has risen 175 per cent. There is only one firm manufacturing carbons in this country at present, and the Government has first claim on its output. The carbon that had the largest sale before the war was the product of an Austro-German firm. This electrode was very popular for all purposes, and little other was used in this country owing to its low price. American carbons, it is said, have not been well regarded here. They are reported to be good and bad in parts, like an imperfect pencil, so that the arc lamp burns satisfactorily until a bad section of the electrode is encountered, when the light splutters and goes out. A satisfactory carbon at a fair price will always find a profitable market here.

SPAIN (MADRID).—There is in Madrid a strong demand for electrical goods, accessories and supplies of all kinds, and it is believed that practically every article in this line can be sold here—but not on the terms usually asked by American exporters. The Spanish merchant has been accustomed to at least 90 days, and he will not trade on any other basis. For example, a Madrid concern recently sent its representative to the American Consulate relative to a transaction in electrical supplies that had been started by this office, and which involved a fairly large amount. The entire negotiation fell through because of the American exporter's insistence for cash against documents. The Madrid merchant stated to the Consul that he still had some German stock on hand; that he would use it until it was exhausted; and that he would then close his shop until the war was over and Germany again entered the market. This attitude is general in the Madrid district.

SPAIN (ALMERIA).—A canvass of the leading dealers in electric light accessories at Almeria discloses the fact that, although general stocks are in no way depleted as yet, such articles as bulbs, wires, wall switches, and lamp supports are not being supplied with any degree of promptness by Spanish dealers or by the foreign firms that heretofore have monopolised this trade. Almeria is a seaport of 50,000 inhabitants; it has good water communication with the other ports of Spain, but lacks direct service with the United States and some countries of Europe. The local consumption of imported articles, excepting certain classes, is insufficient to warrant direct trade therein, it being more advantageous for local merchants to order foreign-made goods from importers located at Barcelona or Madrid, who offer much more attractive terms than American exporters, and are in position to quote prices c.i.f. Almeria. The latter fact is an important consideration with the local dealers. In view of the present inability to draw all electrical supplies from the usual sources, it is believed that there is now an opportunity here for placing American goods. For the reasons already set forth it is thought that the best plan to reach this trade might be to designate a general agent in Barcelona or Madrid, whose salesmen could cover this district.

Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held on the 16th inst., at the Municipal and County Club, Whitehall Court, Whitehall, S.W., when there were present Messrs. Ullmann (East Ham), chairman, Fell (L.C.C.) Schofield (Leyton), Moffat (West Ham) Harvey (Ilford) Stokes (Bexley), Mackinnon (L.U.T.), and Goodyer (Croydon), hon. secretary. Letters and telegrams of regret at inability to attend were received from Messrs. Bruce (L.C.C.), Murray (Walthamstow), Williams (Erith), Pott and Hammond (M.E.T.), Mason (South Met.), and Birkett (Southend-on-Sea).

INDIAN NOTES.

[From our Special Correspondent.]

The War and Electrical Contractors.—Whether due to the consequences of the war or other causes cannot be defined, but a good few small electrical contracting firms in Bombay and Calcutta, and elsewhere through India, have gone bankrupt or disappeared within the last six months. Factors and commission agents at home take serious risks in doing business direct with small firms and bazaar contractors, unless their *bona-fides* are established beyond doubt. Even doing such business through banks is not entirely satisfactory, as very often consignments are refused and thrown back on the home buyer, who often has to dispose of his goods in India at a severe loss rather than have them returned. Now that German and Austrian goods are no longer procurable, manufacturers at home may expect all sorts of inquiries from Indian "firms" of high-sounding name, but before doing any serious business it would be well to have payment in advance. These remarks apply only to comparatively small firms of short standing—there are many old-established firms whose integrity is beyond reproach, and whose business has been built up on a sound basis.

Metal Lamps.—The very unwise game of "beggar my neighbour" is being played just now by firms from whom one would expect better in connection with the sale of metal filament lamps Three such firms have offered to deliver on rail 900 miles from Bombay or Calcutta, 40-watt 220-volt lamps at one rupee per lamp in quantities above one thousand. In the face of increased importing charges one wonders how it can be done, and if it pays.

The Mails.—Mails to India now take, instead of the usual 14 days to Bombay, about 21 days, or even more. This is not to be wondered at, nor do people complain; in fact, considering the position in the Suez Canal and round the southern coast of England, it is surprising that we get our mails with the regularity that we do. A good many home firms make a habit of sending duplicate letters by following mails from home, which seems to be a sound practice.

Fewer Catalogues with Fuller Details Recommended.—Firms in America are inundating India with business circulars and lists, and electrical firms especially are busy in this direction. Both English and American firms make the same mistake in common, namely, they do not give sufficient particulars as to prices, discounts and deliveries. It would save money in postage and printing if fewer catalogues and lists were sent out giving better selling particulars and lowest rates f.o.b. home ports, or c.i.f. India, to a select number of serious firms, whose names can be found in any universal directory.

The Dominions Royal Commission.—The fourth interim report of the Royal Commission on the natural resources, trade, &c., of the Dominions was recently issued; the Commission had reached Newfoundland and Eastern Canada when war broke out, and the members were recalled, and the Commission decided to suspend its sittings until peace was concluded. The report points out that British manufacturers make no organised bid for the trade of Newfoundland and the Maritime Provinces of Canada, which has been largely captured by the United States, but could probably be recovered. The importance of Newfoundland as a cable centre is emphasised, and the report suggests that when existing concessions for landing rights come to be renewed or new ones are sought, the Colony should consult with the Governments of Canada and Australasia, as well as with the Imperial Government, before a decision is reached. A cable and landlines connecting St. John's with Canso belong to the Government of Newfoundland, and may form part of a future State-controlled route between the United Kingdom and Canada. The report states that the island enjoys excellent facilities for communication by cable at cheap rates with Great Britain and Canada, though there are certain anomalies that need rectification. There is also a wireless service in operation between the United Kingdom and Newfoundland, and several coastal stations have been erected.

Liverpool and District Electrical Masters' Association.—A very successful informal evening of this Association was held at headquarters on Wednesday, 14th inst. As a good number of the members of the Association are with the Colours the attendance was not as heavy as usual, but the occasion gave the company an opportunity of expressing their appreciation of the patriotism of the members. The principal toast was "Absent Members at the War," and it was heartily received. Quite a feature of the evening was a stirring speech by Sergt. A. B. Gregson (Lanc. Fortress Royal Engineers), the chairman of the Association.

Zeppelin Raid and Lighting.—As a result of the airship raid on the N.E. Coast last week, several cities were suddenly deprived of electric light for a time, and much inconvenience resulted. At Newcastle both electric lighting and tramway services were suspended; at York the electric lighting supply was cut off for a time, and in Leeds and Hull similar precautions were taken, but the tramways were apparently not seriously interfered with.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

5,168. "Magneto ignition for internal-combustion engines of motor vehicles and the like engines." J. W. T. Cadett & C. Percy. April 6th.

5,174. "Microphone." E. M. C. Tigerstedt. April 6th. (Convention date, April 9th, 1914, Germany.) (Complete.)

5,175. "Magneto ignition for internal-combustion engines of motor vehicles and the like engines." J. W. T. Cadett & C. Percy. April 6th.

5,184. "Electric-light systems more particularly adapted for vehicles." R. Bosch (firm of). April 6th. (Convention date, June 8th, 1914, Germany.) (Complete.)

5,200. "Electro-magnetically-operated devices." E. T. R. Murray & G. F. Shotter. April 6th.

5,201. "Circuit breakers, current limiters, excessive current indicators, and the like for electric circuits." E. T. R. Murray & G. F. Shotter. April 6th.

5,224. "Electrically-operated reversing-mechanism for planing machines and the like." R. McK. Robertson & J. Lennox. April 7th.

5,260. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., N. Shuttleworth, & G. M. Brown. April 7th.

5,261. "Device for testing the actual available working current in electric batteries or cells." A. A. Lyon. April 7th.

5,292. "Cord grips for electric-lamp holders or other electrical fittings wherein grip cords are employed." R. Wheeler. April 8th.

5,307. "Electro-magnetic switches." British Thomson-Houston Co., Ltd. (April 8th.) (General Electric Co., United States.)

5,319. "Process of and apparatus for adjusting electricity meters." O. T. Blathy. April 8th. (Convention date, April 9th, 1914, Germany.) (Complete.)

5,323. "Miners' electric safety lamps." J. G. Patterson. April 8th.

5,342. "Receiving arrangement for wireless telegraphy." Ges. fur Drahtlose Telegraphie m.b.H. April 9th. (Convention date, April 9th, 1914, Germany.) (Complete.)

5,351. "Electrically-heated hot-air syringe for dental or surgical use." J. M. Vaughan. April 9th. (Complete.)

5,371. "Manufacture of electrical condensers." Marconi's Wireless Telegraph Co., Ltd., & C. Mitchell. April 9th.

5,373. "Method of and means for amplifying electric potential variations." British Thomson-Houston Co., Ltd. April 9th. (General Electric Co., United States.)

5,385. "Intercommunication telephone systems." International Electric Co., Ltd., R. G. le Noir, & E. Funcius. April 9th. (Complete.)

5,395. "Electric batteries." H. G. C. Thofehrn. April 9th. (Complete.)

5,412. "Electric lamps and holders for the same." T. Smith. April 10th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

29,622. Electrical Resistances. J. Collinson. December 23rd. (July 17th, 1914.)

1914.

4,017. Electric Heaters. J. R. Quain. February 16th.

4,131. Train Electric Control Systems. B. Starie. February 17th.

4,542. Electrically-driven Pendulum Contact-makers and Breakers for the Control of Current for Electro-medical purposes. E. E. Greville February 21st. ((Addition to 11,274/13.)

4,758. Electric Lamp Stand. F. W. Golby (Wizard Electric Lamp Co.). February 24th.

6,424. Electrically-operated Steering Gear and Analogous Apparatus. W. H. Scott. March 13th.

7,218. Electrical Impulse Transmitters and the like. Betulander Automatic Telephone Co. & G. H. Bryant. March 21st.

7,311. Means for supporting Electric Incandescent Lamps. G. Weissmann. March 23rd. (March 31st, 1913.)

7,561. Shock-absorbers for use with Electric Lamps. M. Camillerapp. March 25th. (April 1st, 1913.)

7,907. System of Operating Electric Control Mechanisms for Printing Telegraphs and the like. Western Electric Co. (Western Electric Co.). March 28th.

7,974. Telephone Transmitters. C. H. Pritchard. March 30th.

8,526. Electrical Indicating Apparatus. H. M. Harding. April 4th.

9,065. Method and means for Protecting Apparatus on Alternating-current systems. A. G. Collis and Crompton & Co. April 9th.

9,213. Electric Cooking Ovens. I. T. Negus & L. Negus. April 14th.

10,516. Electric Safety Control Apparatus for Steam Engines and other prime movers. R. Campbell. April 28th.

20,132. Electric Resistance Controllers. A. H. Curtis, — Mackley, and Igranic Electric Co., Ltd. September 24th.

20,308. Apparatus for Converting Electric Currents. Ester & Co., Ltd., and A. P. Strohmenger. September 29th.

23,495. Electric Resistance Furnaces. G. Gmür-Zehnder. December 3rd.

1915.

767. Door Lock and Contact for Electric Elevators. H. P. McColl. January 16th. (January 23rd, 1914.)

1,376. Electric Cooking Ovens. I. T. Negus & L. Negus. January 26th. (Divided application on 9,213/14, April 14th.)

1,869. Vapour Electric Devices. S. W. Farnsworth & O. P. Schuster. February 5th. (February 5th, 1914.)